

Operating Instructions

**Dryers for coating materials
acc. to EN 1539**

LTU 60/60



GB

Valid for:

Maximum dissolvent concentration of <25 % of the lower explosion limit (LEL)

Type	Rated current
Number of the unit	Input power
Year of construction	Rating
Rated voltage	Connection diagram
Nominal temperature	Working space
Minimum extracted-air flow rate	Total vapour volume
Highest temperature of the heating surface above 750 °C	
Maximum permissible quantity of dissolvent	
For other quantities of dissolvent please refer to the operating instructions!	

Read the Operating Instructions, observe them and keep them close to the device!

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1 IMPORTANT NOTICE



Read carefully and observe these operating instructions before erecting and commissioning the unit to avoid errors and the damages caused by them.

Keep the operating instructions close to the unit.

1.1 Use corresponding to its intended purpose



According to EN 1539 the dryer for coating materials with electrical heating series LTU is exclusively suitable for:



- Drying and hardening of liquid coating materials, containing combustible dissolvent which could form with air an explosive gas atmosphere.
The maximum admissible quantities of dissolvent as of section 2.5 Quantities of Dissolvent are to be observed.

- Combustible materials of the explosion group II A and II B may be used here.



A forbidden use which is not corresponding to its intended purpose is given at:

- Overloading the dryer with dissolvents, the coating system or changing the carrier material without recalculating the dissolvent values to be expected in the dryer
- Heating and storing of materials of the explosion group II C and explosive materials.
- Heating and storing of foodstuffs.
- Enabling the stay of living beings in the dryer and risking their life by that.

If you have doubts about special heat treatments please contact us.

Important notice

1.2 Demands to the production manager



The unit must be operated only by instructed personnel.

Based on these Operating Instructions the production manager has to prepare a corresponding instruction book.

This instruction book has to consider the individual local and working conditions and the language of the operators.

The production manager has to guarantee that all persons working on the unit (dryer) are familiar with the safety information and observe them.



Work on electrical installations and components has to be carried out only by a skilled electrician.

1.3 Manual instructions



The user has to prepare an instruction book for every dryer considering the operating instructions manual and the local working conditions which is easily understandable to the operating personnel and in their language.

The instruction book has to contain particularly indications about which steps are to be taken when interruptions occur.

Notes:

The instruction books include e.g. information about:

- Dissolvents used,
- Maximum admissible dissolvent quantities for every working condition,
- Drying temperature (circulating air temperature),
- Hazards created by the materials or formulations used and the corresponding protection steps required,
- Steps to be taken at interruptions,
- Precautions to be taken when entering the dryer,
- Indications for maintenance.

1.4 Loading instructions



The user has to prepare an instruction about the maximum admissible load depending on the charging material for every dryer (loading instructions).

Notes:

The loading instructions have to indicate the maximum admissible quantity of dissolvent considering the size, the quantity and the coated surface of the parts to be dried for each case.

→ please observe section "2.5 Quantities of Dissolvent" (page 15)

The solvent quantities may be also calculated again for establishing a loading instruction.

→ please observe section "2.6 Calculation of the solvent quantities" (page 17)

The contractor has to make the instruction book and the loading instructions available to the operating personnel and has to secure its observance by e.g. regular training / instruction of the operators.

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1.5 Guarantee



The unit must not be changed in the version as it was supplied by us.



A guarantee will only be granted if you act according to the directions of these Operating Instructions.



The processes of development, production and shipping are according to the regulations of DIN ISO 9001.



The safety and serviceability of the equipment is only guaranteed if the necessary checks and repair works are carried out either by expert skilled personnel or by our service people.



Maintenance and cleaning may be carried out by customer's specialised people.
→ *please see section "7 Maintenance" (page 73)*



Only original spare parts are to be used at maintenance and repair work.



The unit has been designed, manufactured and controlled before shipment according to the regulations of the EC.

Certificate of Conformity / Manufacturer's Declaration:

→ *please see section "10 Documentation" (page 87)*

The unit corresponds to the following safety regulations:

- | | |
|--|--|
| ● EC machine guideline | 98/37/EG |
| ● Low tension guideline | 73/23/EWG |
| ● Dryers and ovens
safety requirements | EN 746-1 |
| ● Safety of machines | EN 12100-1 (2003)
EN 12100-2 (2003) |
| ● Safety in
electric-heating installations | EN 60519-1 EN 60519-2 |
| ● Electrical equipment
of units | EN 60204-1 |
| ● Electromagnetic compatibility
noise emission
noise immunity | EN 61000-6-4
EN 61000-6-2 |
| ● Dryers and ovens, in which flammable
substances are released
- Safety requirements | EN 1539 |



For the safety against explosions the erection and installation is very important as well as a correctly installed and duly functioning ventilation which is to be installed by the customer!

Important notice

1.6 Special marks / indication of hazards



ATTENTION / DANGER

If these instructions are not observed this may lead to a hazard for the life of human beings and other living beings of the environment, or to damages of the unit or the loading material.



ELECTRIC POWER

It is used for drawing the attention to electric power.
Access to this area is only allowed to skilled electricians.



NOTE

It is used to indicate a support.



HOT SURFACE

The air of the drying space and the parts getting in contact with the air of the drying space may be very hot.
Wear protective clothing (protective gloves)



INJURIES OF THE HANDS

A general danger of injuries like cutting or contusion is indicated.
Wear protective gloves!



DANGER OF EXPLOSION

An explosion may occur if the instructions are not observed.



Abbreviations

EN = Europäische Norm
= European Standard

EMV = Elektro-Magnetische-Verträglichkeit
= Electromagnetic Compatibility

UEG = Untere Explosionsgrenze
= Lower Explosion Limit

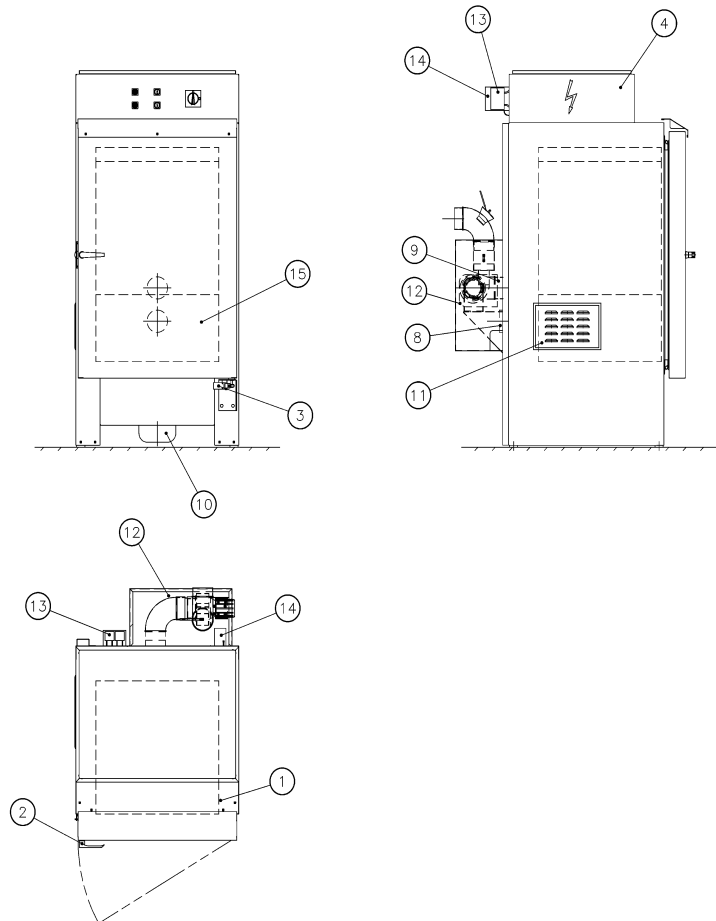
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2 DESCRIPTION OF THE UNIT

2.1 Description of the Items

(Description of the standard unit without additional equipment)



- 1 Door
- 2 Door lock
- 3 Door switch
- 4 Switch box
- 5 Temperature sensor (without representation)
- 6 Bracket ^{1.)} (without representation)
- 7 Insert ^{1.)} (without representation)
- 8 Supply air fitting
- 9 Exhaust air fitting
- 10 Motor with fan impeller (circulating air)
- 11 Heater
- 12 Exhaust air fan
- 13 Flow indicator (exhaust air, circulating air)
- 14 Safety-Temperature Limiter (STL) (without representation)
- 15 Floor sheet (without representation)

^{1.)} additional equipment

Description of the unit

2.2 Structure

Thermal insulation:

The drying chamber for coating materials is a double-wall construction of steel metal sheet and heat insulated with mineral fibre (80 mm).

Circulating air:

A good distribution of temperature and flow in the working space of the unit is given by a high flow rate of circulating air.

A hot gas ventilator is installed under the floor of the working space.

Heating:

The electrical heating is done by tubular heating element of stainless steel (material 1.4828).

Temperature regulation:

The temperature of the working space is controlled by an electronic temperature regulating system with semiconductor switching elements.

Vertical air guiding:

The air entry is at the top side of the working space and the air extraction is at the bottom of the working space.

Horizontal air guiding: ^{1.)}

The air entry is at the rear side of the interior space with an air stream to the front side. The air extraction is at the bottom of the working space.

Interior housing:

The housing is welded tight to avoid the penetration of dissolvent fumes into the thermal insulation.

Safety against explosions:

The safety against explosions in the working space is achieved by a technical ventilation and by the limitation of the quantity of dissolvent.

Minimum extracted-air flow rate:

The air in the working space is exchanged continuously.
(100% flow of exhaust air during the main evaporation time).

Reduced extracted-air flow rate:

The reduced extracted-air flow rate is at least 25 % of the minimum extracted-air flow rate when the exhaust air fan is disconnected.

Control of the circulating- / extracted-air:

The circulating- / extracted-air flow rate is controlled by flow indicators which are separated and operating independently from each other.

Pick-up of material:

Notched rails mounted at the side for the pick-up of angular supports.

Different kinds of inserts (wire-mesh shelves, gratings, loading trays, etc.) may be placed on the angular supports.

The floor of the working space is not to be loaded.

Total load of the notched rails:

→ please observe section "2.4 Technical data" (page 13)

^{1.)} additional equipment

2.3 Function

The drying chamber for coating materials series LTU is designed and constructed according to EN 1539.

When the dryer is loaded with feeding material the and the doors are closed, the feeding material in the working space is enclosed in a turbulent stream of circulating air.

The turbulent circulation takes care of a good and equally distributed heat transfer to the drying goods.

A defined quantity of exhaust air (= minimum extracted-air flow rate) is extracted continuously from the circulating air flow by an additional exhaust air fan.

A corresponding volume of supply air is aspirated by the developing vacuum and mixed with the circulating air.

This air exchange is important for the safety!

By the air volume fed the mixture of dissolvent vapour / air created in the dryer is kept under the lower explosion limit.

→ please observe section "5.2 Main evaporation time" (page 46)

The circulating air flow rate and minimum extracted-air flow rate are controlled by flow switches operating independently from each other (differential pressure flow switches).

The volume flow mixed with supply air and circulating air is aspirated passing the electrical heater and fed to the working space by the circulating air fan.

When the doors of the dryer are open, the heating and the circulating air fan are disconnected for the protection of the operating personnel.

The circulating air are connected automatically when the doors are closed.

The heating has to be connected manually by the operator after checking the drying temperature set at the pertaining operating and loading instructions.

When restarting (main switch on) the heating can be connected only after a safety scavenging time (5-times air exchange in the complete vapour space at the minimum extracted-air flow rate) at closed unit door.

Minimum extracted-air flow rate is according to the flow rate laid out for the maximum dissolvent quantity which may be brought into the dryer for each batch.

Evaporation mean time is according to the time where the main quantity of dissolvent is evaporating and carried off

→ please observe section "5.2 Main evaporation time" (page 46)



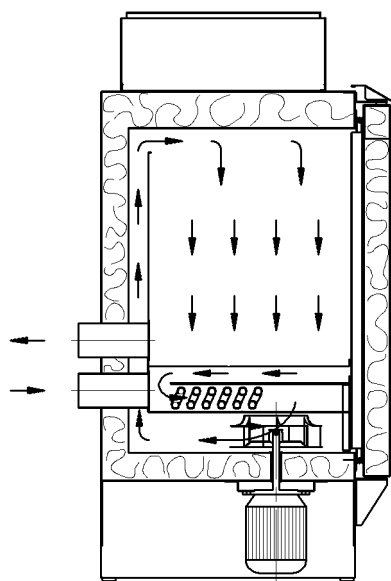
Description of the unit

2.3.1 Air guiding

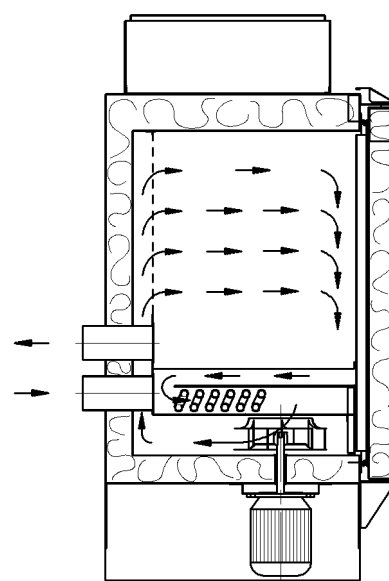
Conversion to horizontal air guiding ^{1.)}

- Loosen the screws at the rear wall of the interior housing.
- Remove the unperforated rear wall sheet of the vertical air guide.
- Insert the perforated rear wall sheet of the horizontal air guide and fasten the screws.

The conversion from horizontal air guiding to vertical air guiding is done in reverse order.



Vertical air guiding



Horizontal air guiding ^{1.)}



The use of loading trays is only possible at horizontal air guiding.

^{1.)} additional equipment

2.4 Technical data

			60/60
Interior space (working space)		m ³	0.216
Interior dimensions			
Width		mm	600
Height			600
Depth			600
Exterior dimensions			
Width	total	mm	796
Height			1700
Depth			850
Loading / carrying capacity			
Interior housing	total	kg	150
	reinforced ^{1.)}		300
Floor	surface load	kg	---
	reinforced ^{1.)}		---
Wire-mesh shelves ^{1.)}			12
	quantity	max.	10
	concentrated load	kg	20
	surface load		
Gratings ^{1.)}	concentrated load	kg	50
	surface load		200
Weight (net)		kg	275
Minimum extracted-air flow rate		m ³ /h	90
Reduced extracted-air flow rate			22.5
Scavenging time (5-times air exchange)		sec.	90
Circulating air flow rate			
	standard	m ³ /h	16
	reinforced ^{1.)}		33
Total vapour volume		m ³	0.414

^{1.)} additional equipment

Description of the unit

		60/60
Sound pressure level (acc. to DIN 45635)	dB(A)	< 70
Disconnecting temperature		
Safety-Temperature Limiter (STL)	°C	300
Temperature limit cut-out (TLC)		200
Temperature-Safety Class (acc. to EN 60519-2)		
Safety-Temperature Limiter (STL)		1
Temperature limit cut-out (TLC)		2
Nominal temperature	°C	200
Electrical data	for differing data please see nameplate	
Rated voltage / frequency	V / c/s	400, 3/(N)PE, AC 50/60
Rated current	A	11.0
Rated power	kW	6.0
Input power	kW	7.0
Reinforced heating power ^{1.)}		
Rated current	A	22.0
Rated power	kW	12.0
Input power	kW	13.0

^{1.)} additional equipment

2.5 Quantities of Dissolvent

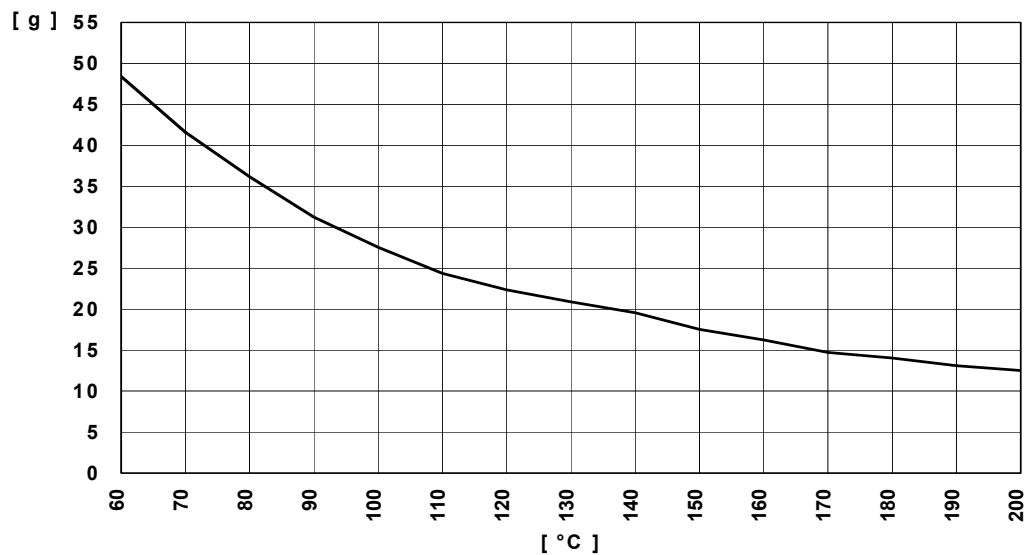
These values are valid for a surface coating containing a dissolvent at 40 g/m³ and 20°C with a max. concentration of < 25 % of the lower explosion limit (LEL).
(calculated according to EN 1539)

The maximum permissible quantity of dissolvent [g] is the quantity which is allowed to be fed in the dryer for each batch at the corresponding minimum extracted-air flow rate and at the corresponding drying temperature [°C].

For drying of mould varnish the dissolvent quantity may be raised to a value of 10 times of the standard.

For drying of impregnating resin the dissolvent quantity may be raised to a value of 20 times of the standard.

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Description of the unit

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2.6 Calculation of the solvent quantities



The solvent quantities for chamber dryers must be calculated again when the operating conditions are deviating or changing.

Drying of mould varnish

If the chamber dryers are used for the drying of mould varnish the data for the maximum allowable quantities of inflammable materials may be increased by up to 10 times.

Drying of impregnating resin

If the chamber dryers are used for the drying of impregnating resin the data for the maximum allowable quantities of inflammable materials (solvent quantities) may be increased by up to 20 times for the surface drying.

Main evaporation time

The main evaporation time after loading the heated chamber dryer is at least

- 5 minutes when drying surface coated material,
- 15 minutes when drying mould varnish,
- 60 minutes when drying impregnating resin,

However when the dryer is loaded before heating it up the main evaporation time is equal to the time until the drying temperature is reached.

When drying mould varnish the main evaporation time is equal to the time until the drying temperature is reached plus 5 minutes at least.

When drying impregnating resin the main evaporation time is equal to the time until the drying temperature is reached plus 30 minutes.

A shorter main evaporation time can only be accepted when the corresponding safety is proven.

Predrying losses

The predrying loss may be estimated as follows for surface coated parts:

After an average predrying time of

10 minutes - 25 %

20 minutes - 45 %

30 minutes - 50 %

of the applicated quantity of inflammable materials (solvents).

The predrying loss may be estimated as follows for mould varnish drying:

After an average predrying time of

10 minutes - 15 %

20 minutes - 25 %

30 minutes - 35 %

40 minutes - 40 %

50 minutes - 45 %

60 minutes - 50 %

of the applicated quantity of inflammable materials (solvents).

The average predrying time for chamber dryers is half of the time which is needed for coating the goods of one charge plus an eventual waiting time after coating until they are loaded into the dryer.

Description of the unit

Calculation of the maximum admissible solvent / varnish quantities for a chamber dryer:

For the calculation of the maximum admissible solvent / varnish quantity the lower explosion limit (LEL) of the solvent in [g/m³] is required.

If the lower explosion limit (LEL) of the solvent is indicated in [Vol%], the molar mass M_{mol} in [g/mol] is also required for the conversion to [g/m³] (LEL).

$$LEL \left[\frac{g}{m^3} \right] = \frac{M_{mol} \left[\frac{g}{mol} \right]}{0,024 \left[\frac{m^3}{mol} \right] \times 100} \times LEL [Vol\%]$$

If the lower explosion limit and the molar mass of the solvent are unknown, LEL = 40 g/m³ is used.

$$C_{LELadm} < 25 \% LEL$$

$$C_{adm} = \frac{C_{LELadm} \times LEL}{100\%}$$

The evaporation time at the drying temperature used is:

$$t_o = \frac{2,58}{9}$$

The time for an air exchange in the complete vapour space of the dryer is:

$$t_w = \frac{V}{Q_{min9}}$$

If the volume of the loaded goods is more than 10 % of the useful space it has to be subtracted from the total vapour space when calculating the maximum admissible solvent quantity.

The relation of the evaporation time to the time for one air exchange in the dryer is:

$$\frac{t_o}{t_w}$$

The value of γ at t_o / t_w has to be taken from the diagram and used in the calculation of the solvent quantity to be applied:

The total quantity of solvent to be applied is:

$$M_{max} = \frac{C_{adm} \times 293 \times V}{(273 + 9) \times \gamma}$$

A predrying loss of 45 % is estimated at a predrying time of e.g. 20 minutes.

Thus the content of solvent in the coating before predrying corresponds to a value which is by 55 % higher than the value of the solvents contained in the applied varnish.

$$M_{predry} = \frac{M_{max} \times 100\%}{(100\% \angle 45\%)}$$

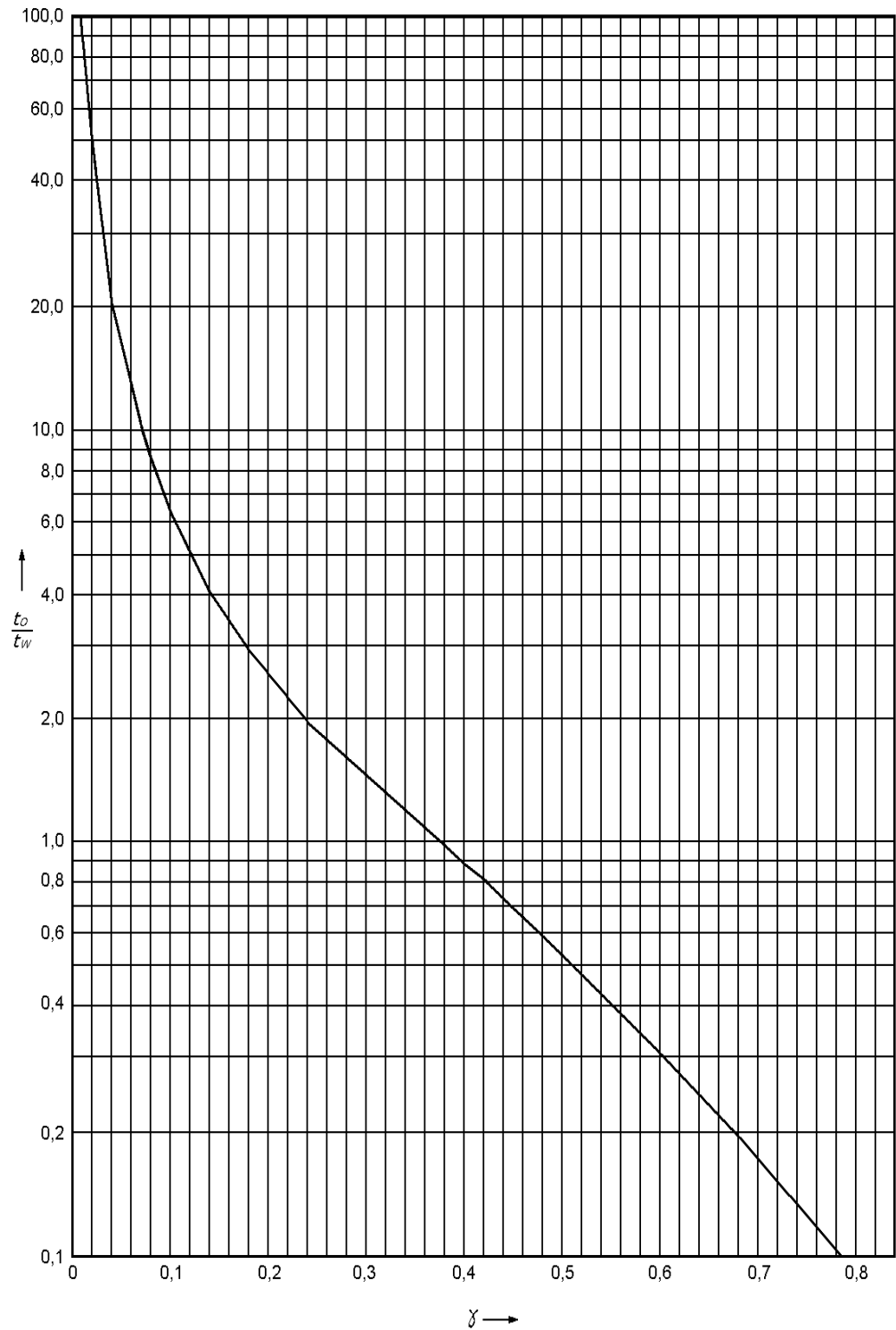
If the content of solvents in the varnish applied is e.g. 60 %, the total weight of the varnish in one charge is:

$$M_{varn} = \frac{M_{predry} \times 100\%}{60\%}$$

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The dependence γ of t_o / t_w has to be taken from the diagram:



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Description of the unit

Calculation sample of the maximum admissible quantity of solvent / varnish for a chamber dryer:

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Total vapour volume	V 0.414 m ³	_____ m ³
Drying temperature	ϑ 190 °C	_____ °C
Minimum extracted-air-flow rate	$Q_{\min\vartheta}$ 102 m ³ /h	_____ m ³ /h
LEL	C_{LEL} 40 g/m ³	_____ g/m ³
max. concentration	C_{LELadm} < 25 %	_____ %
Content of solvent of the varnish	60 %	_____ %
Predrying time / air	t 20 minutes	_____ minutes
$C_{adm} = \frac{C_{LELadm} \times LEL}{100\%}$	$C_{adm} = \frac{25\% \times 40 \left[\frac{g}{m^3} \right]}{100\%} = 10 \left[\frac{g}{m^3(s)} \right]$	$C_{adm} = \frac{\dots \times \dots \left[\frac{g}{m^3} \right]}{100\%} = \dots \left[\frac{g}{m^3(s)} \right]$
Evaporation time at drying temperature $t_o = \frac{2,58}{\vartheta}$	$t_o = \frac{2,58}{190^\circ C} = 0,0136h$	$t_o = \frac{2,58}{\dots^\circ C} = \dots h$
Air exchange in the vapour volume $t_w = \frac{V}{Q_{\min\vartheta}}$	$t_w = \frac{0,414m^3}{102 \frac{m^3}{h}} = 0,00406h$	$t_w = \frac{\dots m^3}{\dots \frac{m^3}{h}} = \dots h$
Relation of $\frac{t_o}{t_w}$	$\frac{t_o}{t_w} = \frac{0,0136h}{0,00406h} = 3,398$	$\frac{t_o}{t_w} = \frac{\dots h}{\dots h} = \dots$
The value for γ at t_o / t_w has to be taken from the diagram:	$\gamma = 0,16$	$\gamma = \dots$
Max. quantity of solvent to be applied $M_{max} = \frac{C_{adm} \times 293 \times V}{(273 + \vartheta) \times \gamma}$	$M_{max} = \frac{10 \left[\frac{g}{m^3(s)} \right] \times 293 \times 0,414m^3}{(273 + 190) \times 0,16} = 16,37g$	$M_{max} = \frac{\dots \left[\frac{g}{m^3(s)} \right] \times 293 \times \dots m^3}{(273 + \dots) \times \dots} = \dots g$
Predrying loss at 20 minutes $M_{predry} = \frac{M_{max} \times 100\%}{(100\% \angle 45\%)}$	$M_{predry} = \frac{16,37g \times 100\%}{(100\% \angle 45\%)} = 29,76g$	$M_{predry} = \frac{\dots g \times 100\%}{(100\% \angle \dots\%)} = \dots g$
Weight of varnish at 60 % content of solvent $M_{varn} = \frac{M_{predry} \times 100\%}{60\%}$	$M_{varn} = \frac{29,76g \times 100\%}{60\%} = 49,6g$	$M_{varn} = \frac{\dots g \times 100\%}{\dots\%} = \dots g$

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2.7 Electrical equipment of the unit

2.7.1 Temperature controller

Jumo dTRON 04.1 ^{2.)}

2.7.2 Temperature controller ^{1.) 2.)}

Jumo dTRON 04.1 with precontact, for gating of a time-lag relay for treatment time with disconnecting of the heating.

2.7.3 Clock relay ^{1.)}

Gating of a clock relay for treatment time with disconnecting of the heating by a precontact of the temperature controller.

Omron

2.7.4 Temperature controller ^{1.) 2.)}

Eurotherm 2204 CC (nominal value ramp)

Eurotherm 2404 CP (1 program, 8 steps)

Eurotherm 2404 P4 (4 programs, je 8 steps each)

Jumo Dicon 1001 (25 programs, integral time switch)

2.7.5 External operation of the program controller ^{1.)}

Separated key for the start of a program as simplified operating of the program controller.

2.7.6 Safety - temperature limiter (STL)

Unit protection

2.7.7 Temperature limit cut-out (TLC)

Jumo iTRON

2.7.8 Door switch

Disconnecting of the heating and the circulating air fan when the door is opened.

2.7.9 Flow indicator (differential pressure switch)

The circulating-air and extracted-air flow rates are monitored each by a differential pressure switch.

2.7.10 Reinforced heating power ^{1.)}

The heating is equipped with 12 radiators.

2.7.11 Reinforced circulating air fan ^{1.)}

Motor of the circulating air fan with double speed.

^{1.)} additional equipment

^{2.)} documentation of the equipment in section 10 Documentation.

Description of the unit

2.7.12 Monitoring unit ^{1.)}

Monitoring of the main evaporation time independent of the program controller.
Automatic switching to reduced exhaust airstream after finishing the main evaporation phase.

2.7.13 Exhaust air fan

The air in the working space / evaporation room is exchanged continuously when the exhaust air fan is running.
(minimum extracted-air flow rate during the main evaporation time)
The air exchange is reduced to 25 % of the minimum extracted-air flow rate when the exhaust air fan is disconnected.

2.7.14 Recorder ^{1.) 2.)}

1-channel- strip chart line recorder Jumo Logoline 500 d
with fixed resistance thermometer Pt 100 beside the controller sensor.

2.7.15 Preparation of the recorder ^{1.)}

with fixed resistance thermometer Pt 100 mounted beside the controller sensor and guided on clamps.

2.7.16 Time switch ^{1.)}

Day-program-clock 24 h

Week-program-clock 168 h

Automatic connection of the unit with switching in of the heating.

Disconnection of the unit.

Grässlin MIL 72

2.7.17 Operating hour meter ^{1.)}

2.7.18 All-round light ^{1.)}

Additional error message or end-of-process message.

^{1.)} additional equipment

^{2.)} documentation of the equipment in section 10 Documentation.

2.8 Mechanical equipment of the unit

2.8.1 Pick-up of material type 60/60

Notched rails

Mounted at the side for the pick-up of angular supports.

Total load of the notched rails

→ *please observe section "2.4 Technical data" (page 13)*

Floor of the working space

Not to be loaded

2.8.2 Angular support ^{1.)}

For the pick-up of inserts.

2.8.3 Inserts ^{1.)}

Wire-mesh shelves

Load of the wire-mesh shelves

→ *please observe section "2.4 Technical data" (page 13)*

Gratings

Load of the gratings

→ *please observe section "2.4 Technical data" (page 13)*

Loading trays

1/1 size

1/2 size

Telescopic rails

for pulling out the inserts.

2.8.4 Door seal

Silicone

Glass fibre ^{1.)}

^{1.)} additional equipment

Description of the unit**2.8.5 Lead-through ^{1.)}**

Diameter 25 or 40 mm in the left or in the right side wall.

2.8.6 Filter ^{1.)}

Fresh air filter class F 5 acc. to EN 779
(only in connection with exhaust air fan)

2.8.7 Kit for fastening the floor anchorage ^{1.)}

Securing device against tilting of the unit with retractable inserts on telescopic rails.

2.8.8 Horizontal air guiding ^{1.)}

Conversion kit for changing the air guiding from vertical to horizontal.

^{1.)} *additional equipment*

3 SAFETY APPLIANCES



Do not make any manipulation at the safety appliances!
Every unauthorised intervention may have unforeseeable consequences.
Danger of explosion!

The function of the safety appliances has to be checked regularly.
→ please observe section "7.1 Testing and maintenance" (page 73)

3.1 Control of the circulating - and exhaust air flow rate

Flow switch



The control of the air flow rates which are necessary for a safe operation during the different phases of operation is done by each a flow switch (differential pressure switch).

The heating is released only when the unit runs correctly.

If the minimum air flow rate is under its minimum value and the circulating air flow fails the corresponding flow switch disconnects the heating permanently and at all poles. At the operating phase with reduced extracted-air flow the unit is switched additionally to minimum extracted-air flow rate.

Indication of the error by optical and acoustic signal.

The acoustic signal is suppressed when the door of the dryer is open.



Rest position monitoring

The motors of the ventilators will start only when the flow indicators are working correctly and when they are in the rest position.

The rest position of the flow indicators for circulating air and exhaust air is checked after every switching on the main switch.

The rest position of the flow indicators for circulating air is checked after every closing of the unit door with the main switch connected.

Safety appliances

3.2 Temperature limitation



Safety temperature limiter (STL)

Thermal protection as device protection (fire protection set firmly at factory, intrinsically break-proof temperature limiter (thermal safety class 1 acc. to EN 60519-2).
The STL is independent from the control equipment electrically and in its function.
If the set temperature is exceeded the STL disconnects the heating permanently and at all poles.
Indication of the error by optical and acoustic signal.
Disconnecting temperature: → *please observe section "2.4 Technical data" (page 13)*



Notice for first commissioning temperature limiter (STL)

The Temperature limiter may trigger during the transport or at temperatures under 0°C.
Consequence at first commissioning:
Unit is connected:

- Red indicator light "error heating" is illuminated.
- **Press the push button** under the screw cap of the STL (at an ambient temperature of at least 20 °C) **firmly with the aid of an appropriate tool.**
- Red indicator light "error heating" goes out.



Temperature limit cut-out (TLC)

Unit protection and material protection (thermal safety class 2 acc. to EN 60519-2).

If the set temperature is exceeded the TLC disconnects the heating permanently and at all poles.

At the operating phase with reduced extracted-air flow the unit is switched additionally to minimum extracted-air flow rate.



Indication of the error by optical and acoustic signal.
Disconnecting temperature: → *please observe section "2.4 Technical data" (page 13)*

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3.3 Control Unit ^{1.)}

For the control of the main evaporation time independent of the program controller and for the automatic switching to reduced exhaust air operation.

Safety circuit:

In the case of a faulty programming or in case of an error in the program controller.

Keep to the main evaporation time set related to the set drying temperature and automatic switching from minimum extracted-air flow rate (fresh air) to reduced extracted-air flow rate (circulating air) only after the controlled main evaporation time has passed.

3.4 Door switch



When the door is opened the heating and the circulating air fan are disconnected and the exhaust air fan is connected by the door switch.

When the door is closed the circulating air fan is connected again by the door switch.

After checking the drying temperature set the heating has to be connected manually pressing a key according to the corresponding Operating- / Loading Instructions.

3.5 Other Safety Appliances



Main switch

Main switch lockable by a padlock.



Protective motor switch

Overload and short circuit protection of the ventilator motors and the control voltage by protective motor switches.



Floor anchoring ^{1.)}

When the unit is equipped with retractable inserts on telescopic rails it is necessary to anchor the unit at the rear side on the floor to avoid a tilting of the unit to the front side due to the weight of the inserts pulled out.

^{1.)} additional equipment

4 ERECTION AND INSTALLATION



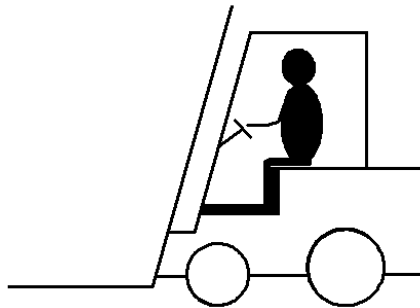
Qualified personnel is required for the transport, erection and installation of the unit!

The corresponding accident prevention rules have to be observed.

4.1 Transport

Shipment is done on a transport pallet.

- Transport the unit to the erecting place with a fork lift or suitable lift truck.
Dead weight → *please observe section "2.4 Technical data" (page 13)*



- Do not use belts for lifting or erecting the unit!

Unit without transport eyes

- Lift the unit carefully at the bottom from the pallet with a fork lift or suitable lift truck.
 - Remove the pallet.
 - Erect the unit at the erecting place
 → *please observe section "4.3 Erection drawing" (page 33)*

We recommend: keep the pallet parts for service or move.

Erection and installation

4.2 Erection



The installation room or area has to be marked as fire endangered.



Please note:

When erecting this unit the area / room has to be characterised as exposed to the danger of fire and has to be equipped with the corresponding installations.



It is not allowed to install and operate the unit in hazardous areas or rooms.

Requirements at erecting:

Standard foundation

- Non-flammable in a periphery of at least 2.5 m
- Flush and horizontal
- Free of vibrations
- Electrically conductive (against electrostatic charging)
- Observe the loading capacity of the floor
Weight of the unit in addition to the weight of the charge.
→ *please observe section "2.4 Technical data" (page 13)*

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Erecting room

- Temperature max. 40 °C
- Dry max. 70 % relative humidity
- Free of draught
- Sufficiently aerated
- Distance from rear side / roof
→ *please observe section "4.3 Erection drawing" (page 33)*
- Supply- and exhaust air conductions
→ *please observe section "4.4 Connection of the supply and exhaust air conduction" (page 35)*
- Install the unit horizontally



Keep the distances indicated in the erection drawing to avoid fire and local overheating of the unit or its surroundings and to guarantee a troublefree operation of it.
→ *please observe section "4.3 Erection drawing" (page 33)*

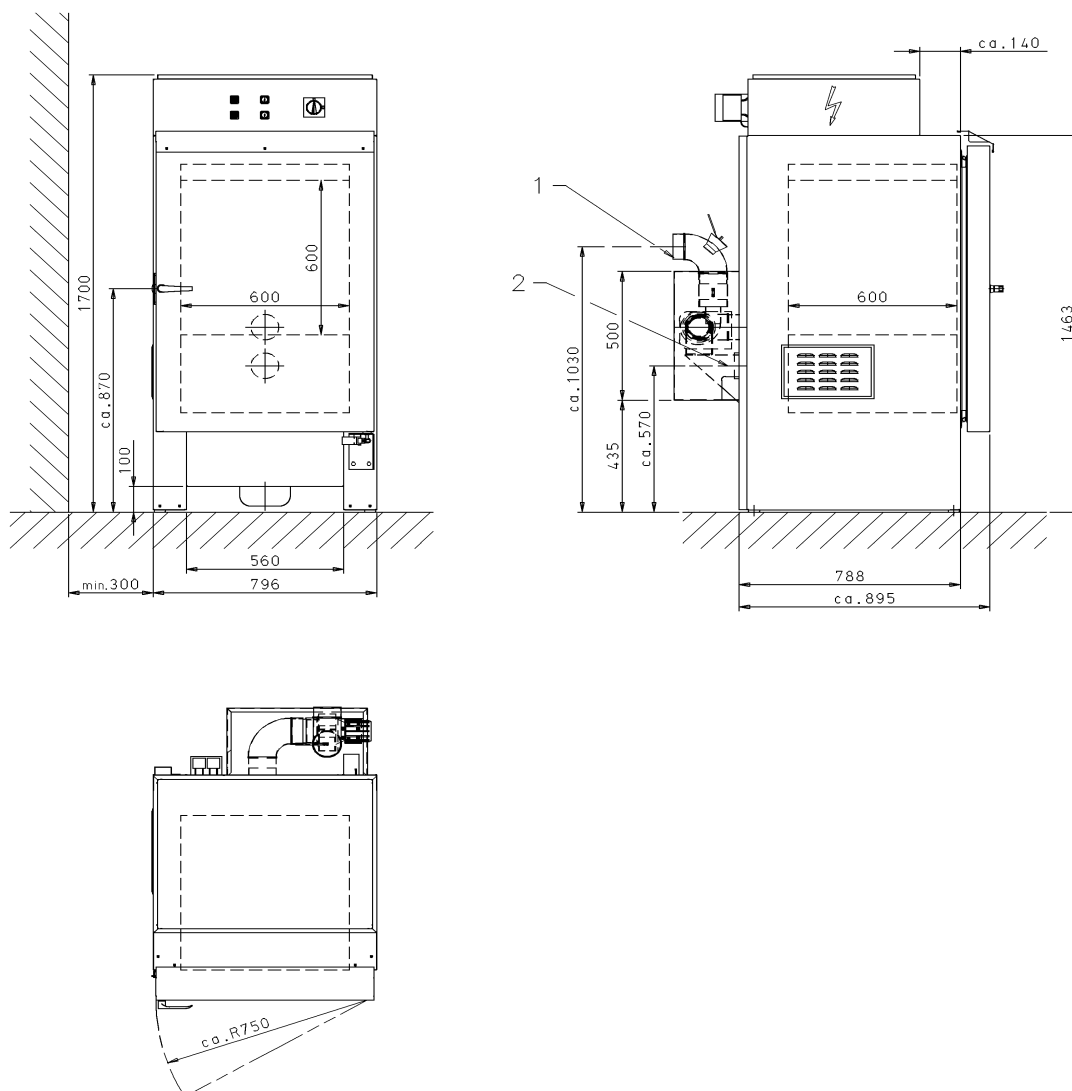
Erection and installation

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4.3 Erection drawing

(Presentation standard unit LTU 60/60 without additional equipment)



- 1 Exhaust air DN 100
- 2 Supply air DN 100

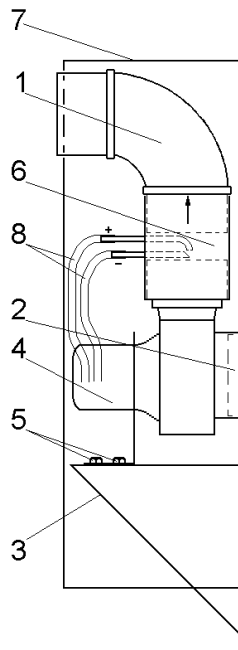
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Erection and installation

4.3.1 Mounting of the exhaust air fan

Assembly of the exhaust air fan and connecting collar when the unit is shipped with disassembled exhaust air fan:

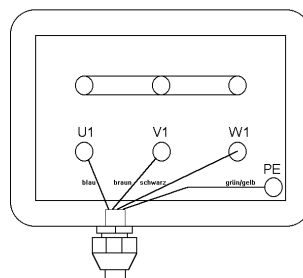
1. Fasten the bracket (3) at the rear wall of the unit.
2. Insert the aspiration side of the exhaust air fan (4) in the exhaust air collar (2) in the rear wall of the unit and fasten it with the hex bolts (5) on the bracket.
3. Insert the socket (6) on the exhaust air fan (4) and the pipe bend (1) in the socket (6). Secure the pipe pieces with sheet metal drive screws.
4. Connect the flexible tubes (8) with the connecting collar and observe the polarity (+ and -).
5. Install the flexible tubes (8) in such a way that they are protected against a heating up by the pipe bend (1) or the exhaust air fan (4).



Make the electrical connection.

1. Guide the end of the cable through the screw joint and fasten the screw joint.
2. Fasten the cable lugs to the indicated terminals.

Colour of the cable	blue	brown	black	green/yellow
Terminal	U1	V1	W1	PE



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4.4 Connection of the supply and exhaust air conduction



- The connection of the supply and exhaust air conduction's has to be done only by qualified persons.



- The total length of the directly connected supply and exhaust air conduction's (NB 100) should not exceed 5 m with max. 3 tube bends (90°) ($R > D$)
An additional extension of the conduction's reduces the extracted-air flow rate
- Supply and exhaust air conduction's have to be installed separated from each other.

4.4.1 Supply air systems



The supply air has to be taken from a neutral area which is free of dissolvent vapours.

Special consideration has to be given to the effects of coated material which is stored in the installation zone of the dryer for predrying.



If it is not possible to take the supply air at the installation area, the unit has to be connected to the customer's supply air system.

The connection has to be tight (NB 100).

The connection at the unit's side must not be loaded mechanically.

The lowest operating temperature of the unit depends on the temperature of the supply air fed.

(Lowest operating temperature = supply air temperature + 20 ... 30 K)



The supply air fed may guided through a fresh air filter and thus cleaned of particles.
(Filter of the class F5 are part of the optional standard accessories.)

4.4.2 Exhaust air systems



Due to the possibly existing vapours and the thermal load the exhaust air should not be guided into the installation area, we recommend the connection to customer's exhaust air system.

If the unit is operated without an exhaust air conduction the necessary distances to the wall and roof have to be considered. **Danger of fire!**

→ please observe section "4.3 Erection drawing" (page 33)

For the discharge of the exhaust air released during the drying and thermal treatment the following has to be considered:

- No possible ignition sources in the in the exhaust air conduction.
- Observation of the valid corresponding national regulations related to the emission values.
- If necessary use exhaust air treatment processes as e.g. thermal or catalytic post-combustion installations (TNV, KNV, etc.).
- The pipes of the exhaust air system have to be of incombustible material (e.g. metal). They have to be installed in a way that no fire hazard could emerge from the developing temperature.
- **Surface temperatures ($T_{\text{surface}} = \text{operating temperature} \leq \text{nominal temperature}$)**

A sufficient thermal insulation has to be provided.
(e.g. pipe casing of mineral fibre)



A measuring orifice ($d = 40\text{mm}$) has to be installed in the exhaust air conduction at a suitable or accessible place (in a straight tube section, about 1m behind the exhaust air collar).

This measuring orifice is necessary for the control of the extracted-air flow rate during the maintenance, checking and service work.

At the conduction installation care has to be taken that it is not possible that deposits build up and that an easy cleaning of the exhaust air line is possible.
(Revision orifices, possibility to dismantle sections, etc.)

By the installation of the pipes for exhaust air it has to be granted that eventually existing condensate will not run back to the unit.

(Install the exhaust air conduction if possible with approximately 2% falling gradient from the unit and drain the condensate specifically into e.g. a condensate trap).

The exhaust air of the unit must not be brought together with fuel-gas.



It is only allowed to guide the exhaust air into chimneys if these do not have a connection with fire places or other workshops.

The exhaust air can only be guided into ventilation shafts if these have a fire-resistant separation to other workshops.

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4.4.3 Exhaust air systems without extraction

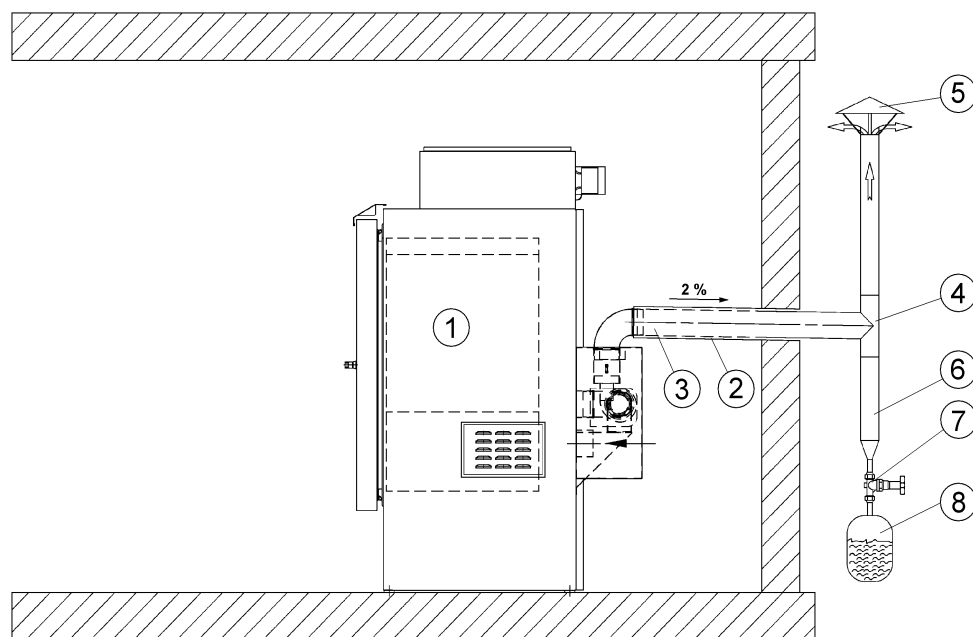


The unit has to be connected directly to an exhaust air line at systems without extraction. It is only possible to connect always one unit to one exhaust air line.

The total resistance to flow with a NB 100 and a total length of 5 m with 3 tube bends (90°) (deducting a possibly existing supply air line and fresh air filter) should not be exceeded at this.



Example for an exhaust air system without extraction:



- 1 Dryer
- 2 Thermal insulation
- 3 Exhaust air line
- 4 Branch
- 5 Roof bonnet, deflector bonnet
- 6 Condensate line
- 7 Shutoff valve for condensate
- 8 Condensation trap

Erection and installation

4.4.4 Exhaust air systems with extraction



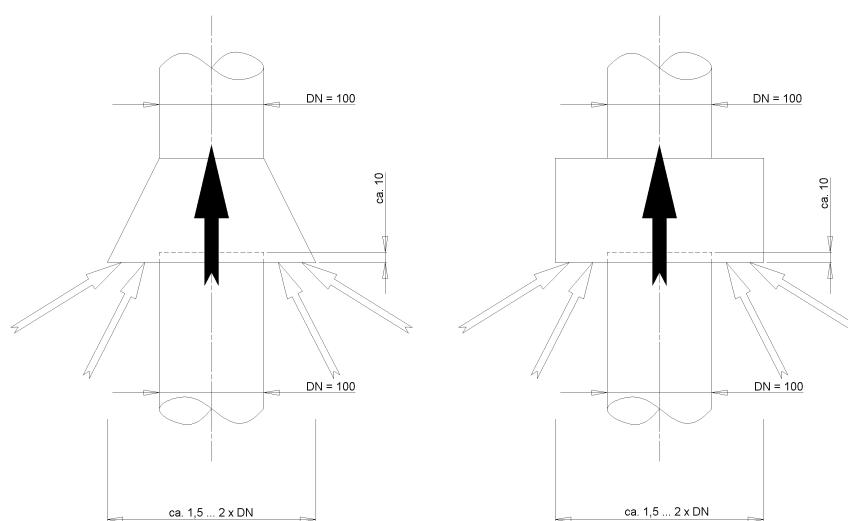
The extracting fan of the exhaust air system has to be suitable for temperatures of the conveying means occurring.

For the connection of the device to an exhaust air system with a central extraction a flue interrupter has to be provided in any case.

A flue interrupter may constructed for example of components of the ventilation techniques usual in the trade.



Examples for flue interrupters:



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Dimensioning of the required extracted-air flow rate at the flue interrupter:

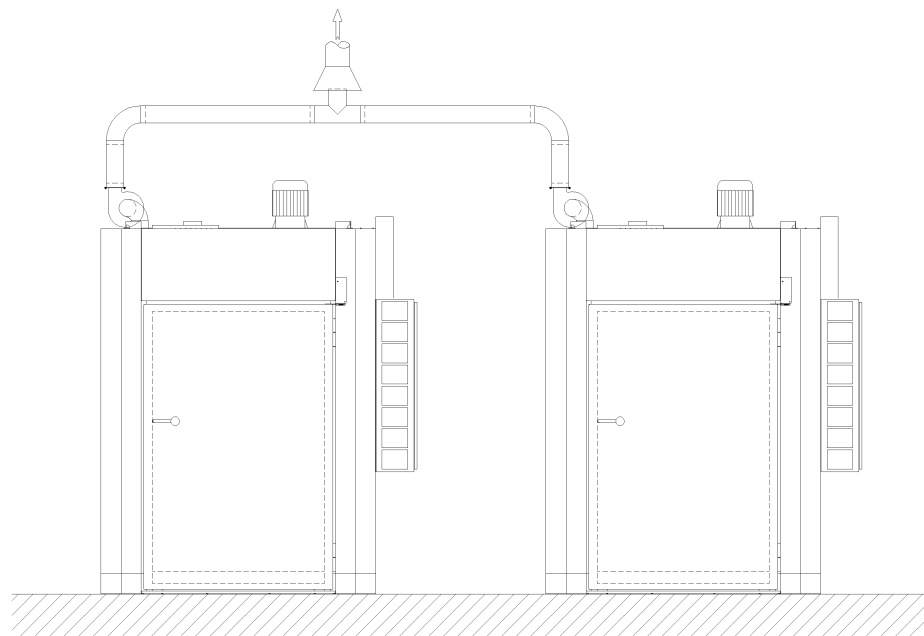
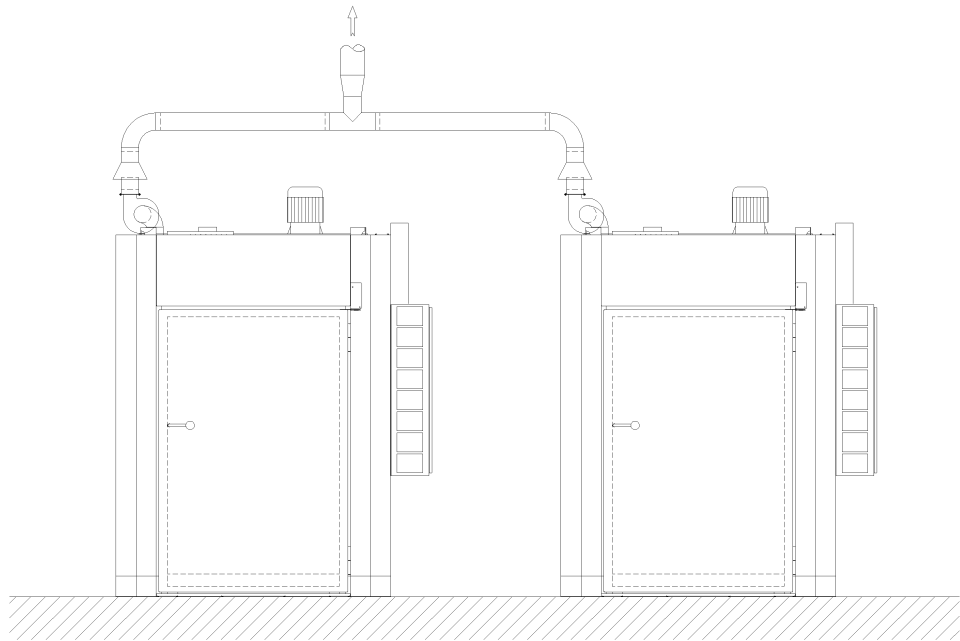
The extracted-air flow rate at the flue interrupter should be dimensioned as follows:
Quantities of exhaust air: → *please observe section "2.4 Technical data" (page 13)*

	LTU 60/60				LTU _ _ / _ _		
Extracted-air flow rate	V _{ext}	102	m³/h		V _{ext}	---	m³/h
Diameter of the exhaust air collar	D _{exh}	100	mm		D _{exh}		mm
Area of the exhaust air collar $A_{\text{exh}} = \frac{D_{\text{exh}}}{2} \times \frac{D_{\text{exh}}}{2} \times \pi$	A _{exh}	0.00785	m²		A _{exh}	---	m²
Diameter of the flue interrupters	D _{flue}	150	mm		D _{flue}	---	mm
Area of the flue interrupter $A_{\text{flue}} = \frac{D_{\text{flue}}}{2} \times \frac{D_{\text{flue}}}{2} \times \pi$	A _{flue}	0.01767	m²		A _{flue}	---	m²
Amplification factor in the flue interrupters	v	1.15			v	1.15	
Flow rate of the exhaust air fan $V_{\text{flue}} = \frac{V_{\text{ext}} \times A_{\text{flue}} \times v}{A_{\text{exh}}}$	V _{flue}	264	m³/h		V _{flue}	---	m³/h

The length of the exhaust air system and its design (e.g. nominal cross section, number of tube bends, etc.) have at this no influence on the devices.



Examples of exhaust air systems with a central extraction (schematic):



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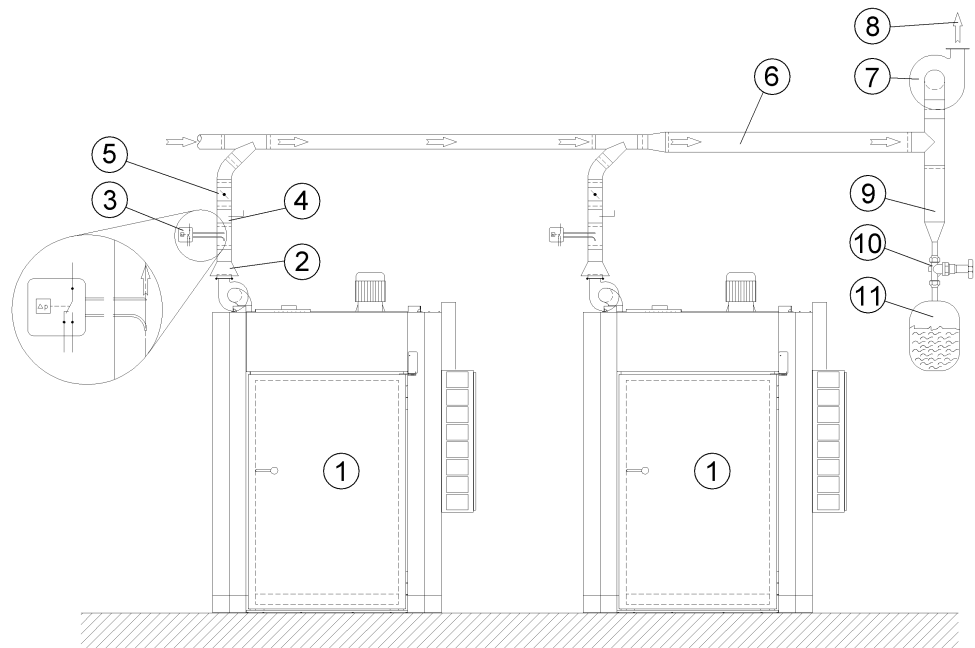
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4.4.5 Connection of several units to an exhaust air system with extraction

If several units are connected to a common exhaust air system with central extraction they have to be locked against each other in the terms of ventilation techniques and the performance of the extracting fan has possibly to be adapted.



Example of several devices on one exhaust air system:



- 1 Dryer
- 2 Flue interrupter
- 3 Flow switch
- 4 Shut-off slide
- 5 Butterfly damper
- 6 Collecting line for flue gas
- 7 Central extracting fan
- 8 Disposal of exhaust air
- 9 Condensate line
- 10 Shut-off valve for condensate
- 11 Condensate trap

Erection and installation

4.5 Electrical Connection



The electrical connection must be done only by skilled electricians.

- Observe the corresponding national regulations for the electrical connection.
- The network conditions have to be in accordance with the data on the nameplate.
- Variations of the mains voltage max. $\pm 10\%$.
- Observe the VDE- and technical connection regulations of the local electricity supply company (EVU).
- Connection to power supply with clockwise rotating field.
- Information about mains connection and necessary fuse protection on the connection diagram.
- We recommend the connection through a leakage current contactor. (300 mA)



The mains connection is in the switch box at the main switch.
The mains connection terminals have to be equipped with a cover.



Sense of rotation of the motor:

Check the sense of rotation of the fan:
Watch the rotation indicating arrow.

Since the sense of rotation of the circulating air fan cannot be seen directly it may be determined as follows:

Remove the bottom sheet metal in the working space:

- Bottom sheet: → *please see section "2.1 Description of the Items" (page 9)*
- Connect and disconnect shortly the main switch.
- The sense of rotation is clockwise if you look from above on the impeller.



Attention! Danger of injuring:
Do not touch the running impeller!

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4.6 Disassembly

Disassembly of the dryer for a change of location.



Separation of the electrical connection has to be done only by skilled electricians.

Transport of the dryer

→ *please observe section "4.1 Transport" (page 29)*



One door has to be removed for safety reasons, to avoid the danger of locking up oneself or somebody.

4.7 Disposal

Disassembly of the unit for disposal.



Separation of the electrical connection has to be done only by skilled electricians.

Transport of the dryer

→ *please observe section "4.1 Transport" (page 29)*



Special waste

There are some electrical and electronic components in the unit which have to be disposed of as special waste if necessary.

If desired we take care of a disposal without endangering the environment.



Disposal by the user

If the user disposes of the unit the following has to be carried out:

- The door lock has to be destroyed or one door has to be removed for safety reasons, to avoid the danger of locking up oneself or somebody.
- Carry the special waste to the corresponding appropriate disposal place.



The nationally and locally applicable regulations for the disposal valid at the time the disposal have to be observed for the other materials and the special waste.

Erection and installation

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5 OPERATION



The following regulations and safety notes have to be observed for the operation.

5.1 Working rules / Safety notes



The unit has to be used exclusively for applications as described in section 1.1 Use corresponding to its intended purpose (page 5)!



Do not make any manipulation at the safety appliances!
Every unauthorised intervention may have unforeseeable consequences.
Explosion hazard!

The control and operation of the dryer is only permitted to instructed operators and only according to customer's "**Manual instructions**".

→ please observe section "1.3 Manual instructions" (page 6)



The loading of the dryer is only allowed according to the "**Loading instructions**" of the customer.

→ please observe section "1.4 Loading instructions" (page 6)



The quantities of dissolvent indicated in section 2.5 are to be observed for the maximum admissible quantity of dissolvent.

For other operating conditions or under consideration of the pre-drying losses the dissolvent quantities have to be calculated anew according to EN 1539.

(please observe section 2.6 calculation of the dissolvent quantities)



If the volume of the loaded material is more than 10 % of the working space, it has to be deducted from the total vapour volume when calculating the maximum admissible quantity of dissolvent.



The loading of the dryer has to be done only if the technical ventilation is active.



Never operate with lacquers made basically of epoxy resin and nitro-cellulose at the same time. (Hazard of spontaneous ignition)



When working with nitro-cellulose lacquers set the temperature controller and the temperature limit cut-out in such a way that the temperature on the material to be dried is not higher than 130 °C.

When loading the dryer leave 25 % of the flow cross section free.

The maximum workplace concentration (MAK-values) have to be observed and a sufficient air exchange in the installation room has to be taken care for.



Keep the working space and equipment, exhaust air line, etc. clean.
Remove thoroughly loading residues. **Fire hazard!**



Keep the dryer free of combustible objects and materials and also don't leave these on the dryer.

The floor of the working space is not to be loaded.

Total load of the notched rails:

→ please observe section "2.4 Technical data" (page 13)

Operation



There are higher temperatures in the region of the door, at heat bridges of the exterior housing and at the piping of the fresh and exhaust air lines.
There is a risk of burning oneself on the inside of the door when it is opened and at the equipment inside (loading material)!

Recommendation:

Use suitable protection equipment.

5.2 Main evaporation time



Operation with minimum extracted-air flow rate during the main evaporation time.
Switch to reduced extracted-air flow rate only after it ran down.

Loading of the preheated dryer:

Main evaporation time for:

Surface coating	at least 5 min,
drying of mould varnish	at least 15 min,
drying of impregnating resin	at least 60 min.

Loading of the cold dryer:

Main evaporation time for:

Surface coating	time until the working temperature is reached,
drying of mould varnish	time until the working temperature is reached plus 5 min,
drying of impregnating resin	time until the working temperature is reached plus 30 min.

5.3 Reaction at interruptions



If an interruption is signalised (optical or acoustic signal):

- Open immediately the door(s) of the dryer!
- Do not load the dryer!
- Empty the dryer!
- Switch the main switch only off after emptying the dryer



The acoustic signal is suppressed when the door(s) of the dryer is(are) opened.

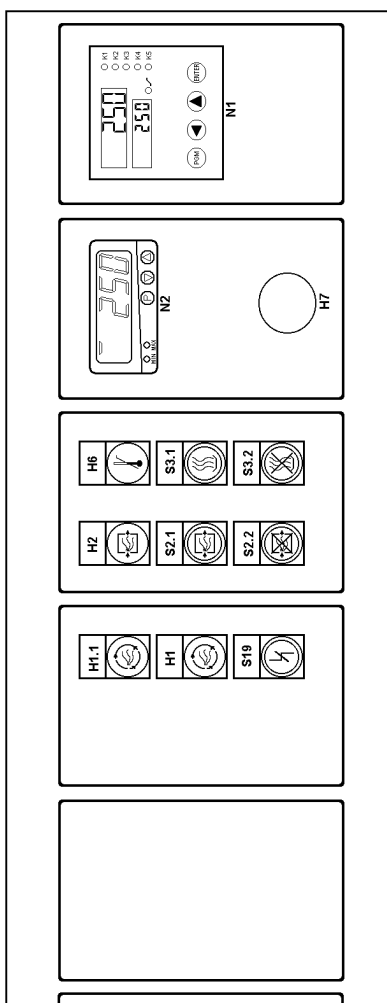


When loading the dryer with products containing dissolvents the corresponding fire extinguishing equipment has to be provided.

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5.4 Switchboard



N1 Temperature controller

N2 Temperature limit cut-out (TLC)

H7 Warning tone generator

H6 Pilot lamp "Error temperature"

S3.1 Luminous push button "Heating on"

S3.2 Push button "Heating off"

H2 Pilot lamp "Error exhaust air"

S2.1 Luminous push button "Exhaust air on"

S2.2 Push button "Exhaust air off"

H1.1 Pilot lamp "Error circulating air"

H1 Pilot lamp "Circulating air"

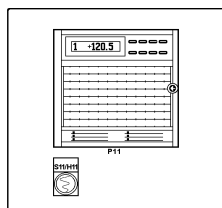
S19 Push button "Reset"

Q0 Main switch

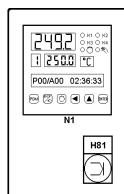
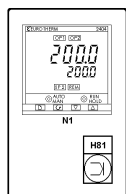
Note:

If the switchboard is different from this presentation the switchboard is illustrated in the appendix to the wiring diagram.

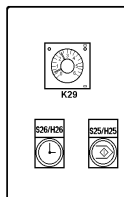
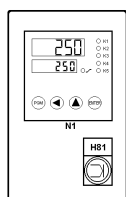
Operation



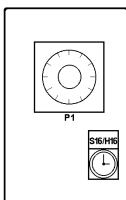
Temperature recorder ^{1.)}



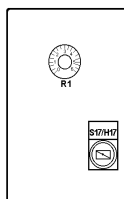
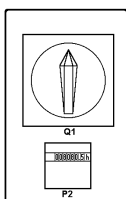
Program controller ^{1.)}



Temperature controller with precontact ^{1.)}
and time-lag relay for treatment time ^{1.)}



Daily-/week-program-time-switch ^{1.)}



Main switch with operating hours meter ^{1.)}

^{1.)} additional equipment

5.5 First commissioning



The following checks have to be carried out before the first commissioning at the empty unit (without loading).

General check:

- **Correct connection of the mains supply.**
- **Correct connection of the supply air and exhaust air lines.**
- **Check the motor safety devices** in the switchbox, **unlock** if necessary.
- **Connect the main switch for a short time and check the sense of rotation** of the motors.
- **Check the power consumption** of the motors.



Check-up of the circulating air and heating:

- **Connect the main switch** at doors closed.
 - Circulating air is connected, pilot lamp "Circulating air" is shining.
 - Exhaust air is connected, pilot lamp "Exhaust air" is shining.
 - Pilot lamp "Heating off" is shining during the scavenging time.



After 5-times air exchange (scavenging time) of the vapour space at closed unit door:
scavenging time: → *please see section "2.4 Technical data" (page 13)*

- Pilot lamp "Heating off" goes out.
- Release for heating operation.
- **Set the rated value of the temperature** at the Temperature controller > space temperature.
- **Press luminous push button** "Heating on".
 - (Pilot lamp "Heating on" went out)
 - Heating is connected, pilot lamp "Heating on" is shining.
- **Verify the power consumption** of the heating.
- **Press the push button** "Exhaust air off".
 - Exhaust air fan is disconnected, pilot lamp "Exhaust air on" goes out.
- **Open the door.**
 - Circulating air is switched off, pilot lamp "Circulating air" goes out.
 - Heating is switched off, pilot lamp "Heating on" goes out.
 - Exhaust air is switched on, pilot lamp "Exhaust air" is shining.
- **Close the door.**
 - Circulating air is switched on, pilot lamp "Circulating air" is shining.
 - Exhaust air stays switched on, pilot lamp "Exhaust air on" is shining.
 - Heating is switched on, pilot lamp "Heating on" is shining.



Notes:

If the circulating air fan does not start again (no start of the unit) the flow indicator "Circulating air" has to be checked.

If during the scavenging time the door of the unit is opened or the key "Reset" is operated, the scavenging time passed will be reset and will start again when the unit door is closed.



Check of the error message Circulating air:

- **Press luminous push button "Heating on".**
 - Heating is connected, pilot lamp "Heating on" is shining.
- **Press the push button "Exhaust air off".**
 - Exhaust air fan is switched off, pilot lamp "Exhaust air on" goes out.
- **Pull off every single measuring hose at the flow switch F1 circulating air control (rear of switch box).**
 - pilot lamp "Error circulating air" is shining
 - Heating is disconnected, pilot lamp "Heating on" goes out.
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
 - Acoustic error message sounds after a time lag.
- **Open the door(s).**
 - Acoustic error message stops.
- **Close the door(s).**
 - Acoustic error message sounds.
- **Push the measuring hoses on again at the flow switch F1 and fix them circulating air control (rear of switch box).**
- **Press push button "Reset".**
 - Pilot lamp "Error circulating air" goes out.
 - Acoustic error message stops.
 - Scavenging time will run down again.
- **Press luminous push button "Heating on".**
 - Heating is connected, pilot lamp "Heating on" is shining.
- **Press push button "Exhaust air off".**
 - Exhaust air fan is switched off, pilot lamp "Exhaust air on" goes out.

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Check of the error message exhaust air:

- **Press luminous push button "Exhaust air on".**
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
- **Press luminous push button "Heating on".**
 - Heating is connected, pilot lamp "Heating on" is shining.
- **Pull off every single measuring hose at the flow switch F2 exhaust air control (rear of switch box).**
 - Pilot lamp "Error exhaust air" is shining.
 - Heating is disconnected, pilot lamp "Heating on" goes out.
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
 - Acoustic error message sounds after a time lag.
- **Open the door(s).**
 - Acoustic error message stops.
- **Close the door(s).**
 - Acoustic error message sounds.
- **Push the measuring hoses on again at the flow switch F2 and fix them exhaust air control (rear of switch box).**
- **Press push button "Reset".**
 - Pilot lamp "Error exhaust air" goes out.
 - Acoustic error message stops.
 - Scavenging time will run down again.
- **Press luminous push button "Heating on".**
 - Heating is connected, pilot lamp "Heating on" is shining.
- **Press push button "Exhaust air off".**
 - Exhaust air fan is switched off, pilot lamp "Exhaust air on" goes out.

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Check of the error message temperature:

For operation: → *please see section "5.6.2 Temperature limit cut-out (TLC)" (page 56)*

- **Set the switch-off-temperature at the temperature limit cut-out (TLC) lower than the present real value (0°C).**
 - Temperature limit cut-out (TLC) switches off, pilot lamp Error at TLC is shining.
 - Pilot lamp "Error temperature" is shining.
 - Heating is disconnected, pilot lamp "Heating on" goes out.
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
 - Acoustic error message sounds after a time lag.
- **Open the door(s).**
 - Acoustic error message stops.
- **Close the door(s).**
 - Acoustic error message sounds.
- **Set the switch-off-temperature at the temperature limit cut-out (TLC) again higher (final value) than the present real value.**
- **Confirm the error at the TLC.**
(Press the **P-key** for 3 sec)
 - Temperature limit cut-out (TLC) switches on, pilot lamp Error at TLC goes out.
 - Pilot lamp "Error temperature" goes out.
- **Press push button "Reset".**
 - Acoustic error message stops.
 - Scavenging time will run down again.
- **Press luminous push button "Heating on".**
 - Heating is connected, pilot lamp "Heating on" is shining.
- **Press push button "Exhaust air off".**
 - Exhaust air fan is switched off, pilot lamp "Exhaust air on" goes out.



After completion of the first commissioning:

- **Prepare a commissioning protocol.**
- **Entry in the device log book.**

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5.6 Operation of the unit, standard equipment



If the equipment of the unit is different to the standard equipment, the description in the sections 5.7 Operation of the unit, additional equipment (page 57) and 5.8 Operation of the unit, special equipment (page 67) has to be observed.

For operation of the equipment please see separate operating instructions in section 10 Documentation.

- **Connect the main switch.**

- Circulating air is switched on, pilot lamp "Circulating air" is shining.
- Exhaust air is connected, pilot lamp "Exhaust air" is shining.
- Pilot lamp "Heating off" is shining during the scavenging time.



After 5-times air exchange (scavenging time) of the vapour space at closed unit door: scavenging time: → *please see section "2.4 Technical data" (page 13)*

- Pilot lamp "Heating off" goes out.
- Release for heating operation.

- **Set the temperature controller.**

For operation: → *please see section "5.6.1 Temperature controller (short instruction)" (page 55)*

- Temperature indication at the temperature controller.
- Temperature controller Jumo dTRON 04.1
- or Eurotherm 2204 and 2404 as fixed command controller



- **Set the temperature limit cut-out at 10 °C above operating temperature.**

For operation: → *please see section "5.6.2 Temperature limit cut-out (TLC)" (page 56)*



- **Load the dryer before or after the heating up** depending on the working process.

→ *please observe section "5.2 Main evaporation time" (page 46)*



The dryer can be loaded only when the technical ventilation (circulating air and exhaust air) is in operation and stays in operation until the drying is finished.

- **Press luminous push button "Heating on".**

- Heating is connected, pilot lamp "Heating on" is shining.



For economic reasons the dryer may be switched to the reduced exhaust air operation -

- **when heating up the unloaded dryer.**
- **when the main evaporation time of the loaded dryer ran down.**

→ *please observe section "5.2 Main evaporation time" (page 46)*

- **Press the push button "Exhaust air off" for that.**

After switching off the exhaust air:

- Switched to reduced extracted-air flow rate,
- Exhaust air fan is disconnected, pilot lamp "Exhaust air on" goes out.

Operation

After the heat treatment or for cooling down the dryer:

- **Press the luminous push button "Heating off" or the luminous push button "Exhaust air on".**
 - Heating is disconnected, pilot lamp "Heating on" goes out.
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
- **Open the door:**
 - Circulating air is switched off, pilot lamp "Circulating air" goes out.
 - Heating is disconnected, pilot lamp "Heating on" goes out.
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
- **Empty the dryer!**
- **Close the door:**
 - Circulating air is switched on, pilot lamp "Circulating air" is shining.
 - Exhaust air stays switched on, pilot lamp "Exhaust air on" is shining.

Shut down



To save the aggregates installed it is not allowed to switch off the unit before it is cooled down under 150 °C.

- **Empty the dryer!**
- **Switch off the main switch.**
 - The dryer is switched off.

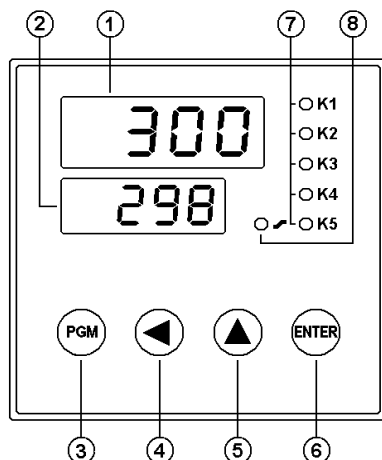


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5.6.1 Temperature controller (short instruction)

Jumo dTRON 04.1



- 1 Actual indication**
7-segment display, red
- 2 Rated value indication**
7-segment display, green
- 3 PGM-key**
Advance of the levels
- 4 Digit-key**
Selection of the decimal point when entering
- 5 Increase-value-key**
Increasing of the decimal point value
- 6 ENTER-key**
Confirming of the input
- 7 Indication of the connecting position**
Indication of the connected output
- 8 Ramp function**
Indication of the ramp function

Setting / changing of rated value

Normal display

- The real value is in the upper display.
- The rated value is in the lower display.

- **Press the PGM-key.**
 - The rated value is shown in the upper display.
 - The indication SP 1 is shown in the lower display.
- **Press the Digit-key.**
 - A decimal point of the rated value blinks in the upper display.
- **Press the Increase-value-key.**
 - The value of the decimal point is increased in the upper display.

Continue pressing the Digit-key and the Increase-value-key until the rated value wanted is shown.

- **Press the ENTER-key.**
 - The blinking of the decimal point in the upper display is stopped.
 - The rated value is stored.
- **Press the PGM-key 3 x.**
 - The real value is shown in the upper display.
 - The rated value is shown in the lower display.

For the further operating of the temperature controller: → *please see section "10 Documentation" (page 87)*

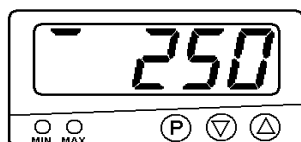


5.6.2 Temperature limit cut-out (TLC)

- Set the temperature limit cut-out at 10 °C above operating temperature.

Setting depending on the purpose of the protection:

1. Protection of the material at rated temperature and protection of the unit at the same time:
Setting to final value:
Disconnecting temperature: → *please observe section "2.4 Technical data" (page 13)*
2. Material protection at operating temperature:
Setting above the operating temperature wanted.



Indication of the current alarm value:

- Operate the **P-key** 1 x shortly.
 - The display shows "**AL**" alternating with the value of the current alarm value. (Alarm Low)

Indication of the current real value:

- Operate the **P-key** 2 x shortly.
 - The display shows "**InP**" alternating with the value of the current real value. (Input)

Indication of the current set value (disconnecting temperature):

- Operate the **P-key** 3 x shortly.
 - The display shows "**AH**" alternating with the value of the current set value. (Alarm High)

Changing / setting of the switch-off-temperature "**MAX**":

- Press the **P-key** and the **Increase-value-key** at the same time for approximately 3 sec.
 - The display shows "**AH**" alternating with the value of the active set value.
- Press the **Decrease-value-key** or **Increase-value-key** alternatively.
 - The selected value is shown on the display.

Storing of the cut-off temperature:

- Press the **P-key**.
 - The value selected is stored.
 - The value of the current cut-off temperature is shown on the display.

If the set temperature is exceeded the TLC disconnects the heating permanently at all terminals.

- Pilot lamp "**MAX**" at TLC is shining.
- The indication of the active set value on the display flashes as long as the disconnecting temperature is exceeded.

After the reducing the temperature under cut-off temperature:

- Pilot lamp "**MAX**" on TLC is blinking.
- The flashing of the indication is stopped, the display shows the active set value.

Acknowledgement of a temperature error:

- Press the **P-key** for 3 sec.
 - The TLC is reset.
 - The flashing of the pilot lamp "**MAX**" at the TLC is stopped.

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5.7 Operation of the unit, additional equipment

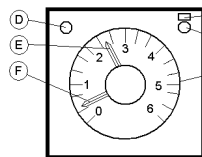
5.7.1 Temperature controller with precontact and time-lag relay ^{1.)}

Selection of a time-lag relay for treatment time with disconnecting of the heating and connecting of the exhaust air.

For operation of the equipment please see separate operating instructions in section 10 Documentation.

● Set time-lag relay "Time schedule"

- Turn the time range set screw "B" with a small screw driver until the time range selected is shown on display "A".
- Turn the setting ring "C" until the indicator "E" is set to the selected runtime.



Function:

- (After winding up the pointer "F" jumps to the pointer "E".
- When selected the pointer "F" moves in direction to 0.
- The time running can be seen on display "D".

● Connect the main switch.

- Circulating air is switched on, pilot lamp "Circulating air" is shining.
- Exhaust air is connected, pilot lamp "Exhaust air" is shining.
- Pilot lamp "Heating off" is shining during the scavenging time.



After 5-times air exchange (scavenging time) of the vapour space at closed unit door:
scavenging time: → please see section "2.4 Technical data" (page 13)

- Pilot lamp "Heating off" goes out.
- Release for heating operation.



● Set the temperature controller.

For operation: → please see section "5.6.1 Temperature controller (short instruction)" (page 55)

- Temperature indication at the temperature controller.
- Temperature controller Jumo dTRON 04.1
- The precontact reacts at 5 K below the rated value.
- Precontact set by manufacturer.



● Set the temperature limit cut-out to 10 °C above operating temperature.

For operation: → please see section "5.6.2 Temperature limit cut-out (TLC)" (page 56)



● Load the dryer before or after the heating up depending on the working process.

→ please observe section "5.2 Main evaporation time" (page 46)



The dryer can be loaded only when the technical ventilation (circulating air and exhaust air) is in operation and stays in operation until the drying is finished.

● Press luminous push button switch "Automatic operation".

- pilot lamp "Automatic operation" is shining.

● Press luminous push button "Start time schedule".

- Time-lag relay "Time schedule" wound up,

● Press luminous push button "Heating on".

- Heating is connected, pilot lamp "Heating on" is shining.

^{1.)} additional equipment

Before reaching the operating temperature (5 °C) the precontact switches on.

- Time-lag relay "Time schedule" is selected, hold time starts running.
- Pilot lamp "Start time schedule" is shining.



For economic reasons the dryer may be switched to the reduced exhaust air operation -

- **when heating up the unloaded dryer.**
- **when the main evaporation time of the loaded dryer ran down.**

→ please observe section "5.2 Main evaporation time" (page 46)

● **Press the push button "Exhaust air off" for that.**

After switching off the exhaust air:

- Switched to reduced extracted-air flow rate,
- Exhaust air fan is disconnected, pilot lamp "Exhaust air on" goes out.

When the set treatment time ran down: ^{1.)}

- Heating is disconnected, pilot lamp "Heating on" goes out.
- Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
- Pilot lamp "Start time schedule" goes out.
- Pilot lamp "End of program" is shining.
- Flash lamp (red) "End of program" is shining. ^{2.)}

● **Open the door:**

- Circulating air is switched off, pilot lamp "Circulating air" goes out.
- Heating is disconnected, pilot lamp "Heating on" goes out.
- Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.

● **Change the charge of the dryer!**

● **Close the door:**

- Circulating air is switched on, pilot lamp "Circulating air" is shining.
- Exhaust air stays switched on, pilot lamp "Exhaust air on" is shining.



program repetition:

- **Press luminous push button "Start time schedule".**
 - A new schedule starts.



Operation without time-lag relay:

- **Switch off the luminous push button switch "Automatic operation".**
 - Pilot lamp "Automatic operation" goes out.
 - Heating is connected, pilot lamp "Heating" is shining.

For further description: → please see section "5.6 Operation of the unit, standard equipment" (page 53)

^{1.)} additional equipment

^{2.)} only for further additional equipment

5.7.2 Program controller Eurotherm 2404 CP ^{1.)}, 2404 P4 ^{1.)} and Jumo DICON 1001 ^{1.)} with control unit ^{1.)} for switching off the exhaust air according to EN 1539.

For operation of the equipment please see separate operating instructions in section 10 Documentation.

- **Connect the main switch.**

- Circulating air is switched on, pilot lamp "Circulating air" is shining.
- Exhaust air is connected, pilot lamp "Exhaust air" is shining.
- Pilot lamp "Heating off" is shining during the scavenging time.



After 5-times air exchange (scavenging time) of the vapour space at closed unit door: scavenging time: → *please see section "2.4 Technical data" (page 13)*

- Pilot lamp "Heating off" goes out.
- Release for heating operation.

Operation with fixed value controller



→ *please see section "5.6 Operation of the unit, standard equipment" (page 53)*

Operation with program controlled rated value (program controller)



Only by authorised personnel.

- **Set the temperature limit cut-out** to 10 °C above operating temperature.

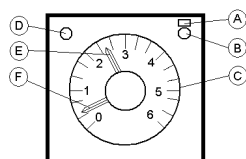
For operation: → *please see section "5.6.2 Temperature limit cut-out (TLC)" (page 56)*

- The precontact "control temperature" reacts at 15 K (15 °C) below switch-off temperature.
- Precontact set by manufacturer.

- **Set the time-lag relay** "Control unit"

- Turn the time range set screw "B" with a small screw driver until the time range selected is shown on display "A".
- Turn the setting ring "C" until the indicator "E" is set to the selected runtime.

→ *please observe section "5.2 Main evaporation time" (page 46)*



Function:

- (After winding up the pointer "F" jumps to the pointer "E".
- When selected the pointer "F" moves in direction to 0.
- The time running can be seen on display "D".

- **Lock the protection cover** of the time-lag relay to exclude an unauthorised resetting.

^{1.)} additional equipment



- **Select the number of program** on a multi-program-controller ^{1.)}.

- **Entering the temperature- / time program.**

→ please see section "Program at delivery: (program sample) ^{1.)}" (page 62)

The operating temperature and the main evaporation time are programmed in the first program section.

This time has to be programmed a little longer than the time of the time-lag relay of the "Control unit".

- Rated value curve
- Contacts depending on the segment
- Channel (control contact) 1 "Exhaust air on"
- Channel (control contact) 2 "Exhaust air off"
- Channel (control contact) 3 "End of program"



- **Load the dryer before or after the heating up** depending on the working process.

→ please observe section "5.2 Main evaporation time" (page 46)

The dryer can be loaded only when the technical ventilation (circulating air and exhaust air) is in operation and stays in operation until the drying is finished.



Only by authorised personnel.



- **Press the keyswitch "Control on".**

- Control unit is ready.

- **Press luminous push button "Heating on".**

- Heating is connected, pilot lamp "Heating on" is shining.



- **Press the key "Start" at the program controller, or press push button "Start program" ^{2.)}.**

- Furnace is heated according to the program.

After reaching the control temperature at the TLC:

- Main evaporation time is running,
- Pilot lamp in the time-lag relay is shining.

After the time-lag relay and the main evaporation time programmed on the program controller ran down:

- Switching to reduced extracted-air flow rate
- Pilot lamp "Exhaust air on" goes out.

The exhaust air can be connected again in the cooling phase by the output channel "Exhaust air on", the heating switched off.

- Heating switched off, pilot lamp "Heating on" is goes out.
- Switched to maximum extracted-air flow rate, pilot lamp "Exhaust air on" is shining.



The exhaust air is connected every time when the door is opened and the control unit has to be started again.

After end of program:

- Pilot lamp "End of program" is shining.
- Flash lamp (red) "End of program" ^{2.)} is shining.

^{1.)} additional equipment

^{2.)} only for further additional equipment

Change of program at multi-program-controller: ^{1.)}

- **Reset program and select program-no.**

Shutoff program controller

- **Reset program** at the program controller.
- **Open the door:**
 - Circulating air is switched off, pilot lamp "Circulating air" goes out.
 - Heating is disconnected, pilot lamp "Heating on" goes out.
 - Exhaust air fan is switched on, pilot lamp "Exhaust air on" is shining.
- **Empty the dryer!**
- **Close the door:**
 - Circulating air is switched on, pilot lamp "Circulating air" is shining.
 - Exhaust air stays switched on, pilot lamp "Exhaust air on" is shining.



To save the aggregates installed it is not allowed to switch off the unit before it is cooled down under 150 °C.

- **Empty the dryer!**



- **Switch off the main switch.**
 - The dryer is switched off.



Note:

If the temperature limit cut-out is set 15 K (15 °C) above operating temperature, the exhaust air is not switched off.

(The temperature limit cut-out has a fix precontact set to 15 K (15 °C) below switch-off temperature which selects the time-lag relay when its temperature is reached. If the setting of the precontact is too high the time-lag relay of the control unit will not get the release to run down since the precontact temperature is not reached.)

At every new start of the program the control unit has to be started again.

When the control unit is switched on, the exhaust air cannot be switched off manually.

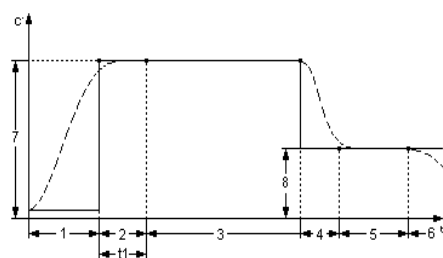


The push button "Exhaust air" can be pressed when the control unit is switched off.
→ *please observe section "5.2 Main evaporation time" (page 46)*

^{1.)} *additional equipment*

Operation

Program at delivery: (program sample) ^{1.)}



- 1 Heat-up time (ramp)
- 2 Hold time
- t1 Main evaporation time
- 3 Treatment time
- 4 Cool down time (ramp)
- 5 Hold time
- 6 End of program
- 7 Treatment temperature
- 8 Discharge temperature

Eurotherm 2404

Prog - list

PrG.n = 1
Hb = bAnd
HbV = 10
rmP.U = Hour
dwL.U = Hour
CyC.n = 1

SEG.n = 1	SEG.n = 2	SEG.n = 3	SEG.n = 4	SEG.n = 5
tyEP = StEP	tyPE = dwEll	tyPE = dwEll	tyEP = StEP	tyPE = End
tGt = 100	dur = 0.1	dur = 0.2	tGt = 50	End.t = dwEll
out 1 - 8 = oFF	out 1 - 8 = oFF	out 1 = oFF	out 1 = on	out 1 - 8 = oFF
		out 2 = on	out 2 - 8 = oFF	
		out 3 - 8 = oFF		

Jumo DICON 1001

PROGRAMEDITOR

CODE-NR. 1000
PROGRAMNR 0.
ZEITPLANPROGR 1.
ABS. EDITIEREN

ABS.-NR.	0.	1.	2.	3.	4.	5.	6.	7.
SOLLWERT	20	100	100	100	100	100	40	40
ABSZEIT	00:00:01	00:00:01	00:10:00	00:10:00	00:00:30	00:00:30	00:00:01	00:06:00
ZYKLEN	0	0	0	0	0	0	0	0
ZIEL.ABS	1	1	1	1	1	1	1	1
STEUERSPUR 1	EIN	AUS	AUS	AUS	AUS	EIN	EIN	EIN
STEUERSPUR 2	AUS	AUS	AUS	EIN	AUS	AUS	AUS	AUS
STEUERSPUR 3	AUS	AUS	AUS	AUS	AUS	AUS	AUS	AUS
STEUERSPUR 4	AUS	AUS	AUS	AUS	AUS	AUS	AUS	AUS
STEUERSPUR 5	AUS	AUS	AUS	AUS	AUS	AUS	AUS	AUS
STEUERSPUR 6	AUS	AUS	AUS	AUS	AUS	AUS	AUS	AUS
STEUERSPUR 7	AUS	AUS	AUS	AUS	AUS	AUS	AUS	AUS
STEUERSPUR 8	AUS	AUS	AUS	AUS	AUS	AUS	AUS	AUS
TOL.-MIN.	-20.	-10.	-10.	-10.	-10.	-10.	-20.	-20.
TOL.-MAX.	50.	10.	10.	10.	10.	10.	70.	10.
PARAM.SATZ	1	1	1	1	1	1	1	1



Set values of the control unit:

- Time-lag relay "Control unit" = 5 minutes
- Temperature limit cut-out = 110 C°

^{1.)} additional equipment

5.7.3 Temperature recorder ^{1.)}

The temperature of the unit / material may be documented by a recorder.

The 1-channel- strip chart line recorder Jumo Logoline 500 d is equipped with a firmly mounted temperature sensor for measuring the temperature of the unit which is placed beside the controller sensor.

The use of a flexible temperature sensor for measuring the material temperature is also possible.

The 6-channel dot-printer Jumo Logoprint 500 is equipped with 1 ... 6 firmly mounted temperature sensors for measuring the temperature of the unit which are positioned in the working space.

The use of flexible temperature sensors for measuring the material temperature is also possible.

At the version with preparation for a recorder (recorder to be supplied by the customer) the temperature sensors are guided on plugs / clamps.

- **Switch on the switch "Recorder"**
 - recorder is switched on,
 - measuring of the temperatures is started.
- **Switch off the switch "Recorder"**
 - recorder is switched off,
 - measuring of the temperatures is finished.

^{1.)} additional equipment

5.7.4 Time switch ^{1.)}

Connecting of the dryer by a switch clock is only allowed at unloaded dryer.

Automatic connection and disconnection of the unit by day-program-clock 24 h or by week-program-clock 168 h.

Running back-up approximately 150 h, to bypass power failures.

- **For automatic operation (with clock) switch on luminous push button "Clock operation".**
 - Pilot lamp "Clock operation" is shining.

Note:

The switch in the program disc (I / ☉ / O) has to be in position clock operation ☉.

The switching position I is for continuous operation connected.

The switching position O is for continuous operation disconnected.

- **Set the time (time of the day and weekday).**
For the coarse setting turn the program disc in direction of the arrow and for the fine setting turn the minute hand further in direction of the arrow.
- **Set the switching program.**
 - Switch-on duration** - engage the switching slider outwards.
 - Switch-off duration** - engage the switching slider inwards.

Day-program-clock 24 h

Switching steps at least 15 min.

Week-program-clock 168 h

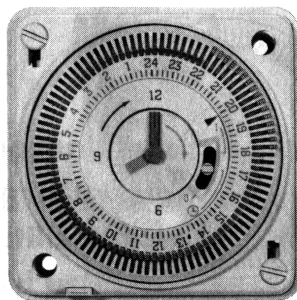
Switching steps at least 2 h.

- Clock connected:**
 - Circulating air and exhaust air switched on.
 - Heating is switched on with delay.
- Clock disconnected:**
 - heating switched off.
 - Circulating air and exhaust air still in operation. ^{2.)}

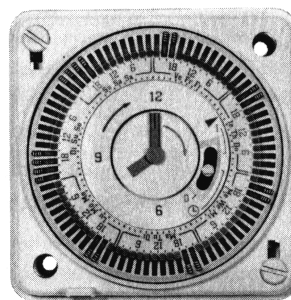
After the temperature in working space dropped under 150 °C: ^{2.)}

- Circulating air and exhaust air switched off.

- **For manual operation (without clock) switch off luminous push button "Clock operation".**
 - pilot lamp "Clock operation" goes out.
 - Circulating air and exhaust air switched on.
- **Press luminous push button "Heating on".**
 - Heating is connected.



Day-program-switch clock 24 h



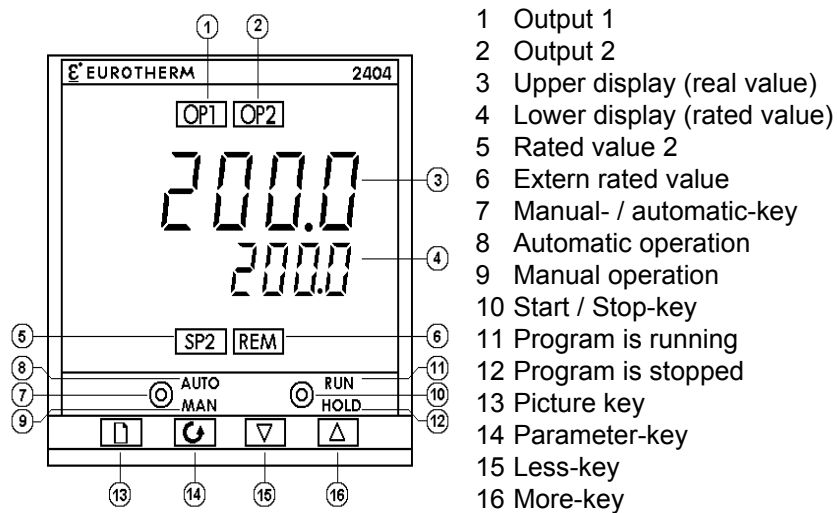
Week-program-switch clock 168 h

^{1.)} additional equipment

^{2.)} only for further additional equipment

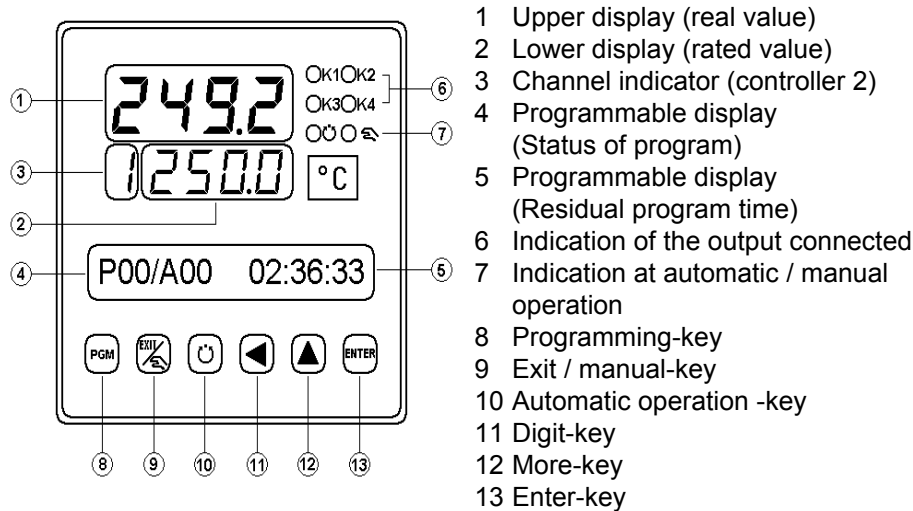
5.7.5 Temperature controller ^{1.)}

Eurotherm 2204 CC (nominal value ramp)
Eurotherm 2404 CP (1 programs, 8 steps)
Eurotherm 2404 P4 (4 programs, 8 steps each)



^{1.)} additional equipment

Jumo DICON 1001 (25 programs, integral time switch) ^{1.)}



Standard indication

- The real value is in the upper display.
- The rated value is in the lower display.
- The controller operation is indicated (controller 1)
- At cascade regulation the channel indication changes between controller 1 and controller 2. ^{2.)}

Set / change the rated value of controller 1

- **Operate the PGM-key.**
 - The rated value is shown on the matrix display.
- **Operate the Digit-key.**
 - A digit of the rated value on the matrix display is blinking.
- **Operate the More-key / Less-key.**
 - The value of the digit on the matrix display is changed.

Continue to operate the Digit-key, the More-key and the Less-key until the desired rated value is shown.

- **Operate the ENTER-key.**
 - The blinking of the digit on the matrix display is stopped.
 - The rated value in the lower display is taken over.
 - The rated value is stored.
- **Operate the EXIT-key.**
 - The controller operation is indicated (controller 1).
- **Set / change the rated value of controller 2 ^{2.)}**
- **Switch-over from controller 1 to controller 2. ^{2.)}**
- **Operate the ENTER-key. ^{2.)}**
 - The channel indication changes from controller 1 to controller 2.
 - The setting of the rated value for controller 2 is done in the same way as for controller 1.

For the further operating of the temperature controller: → *please see section "10 Documentation" (page 87)*

^{1.)} additional equipment

^{2.)} only for further additional equipment

5.8 Operation of the unit, special equipment

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6 ERROR DIAGNOSIS



Failures are to be corrected only by expert skilled personnel.

6.1 Failure at restart

FAILURE	CAUSE	REMEDY
No indication on the controller display, no indication of the pilot lamps	No mains or control voltage	Check the voltage, mains and control fuses
Ventilators switched off, error message circulating- / exhaust air after about 20 sec. (flow switch not in resting position)	a.) User's extraction installation without flue interrupter (fixed connection) b.) * Flow switch doesn't react c.) Motor protection switch has triggered	a.) Install flue interrupter in user's extraction installation b.) * Check the flow switch, measuring hose and measuring set c.) Press on-key; check motor protection switch
Ventilation in operation heating disconnected, (circulating air fan off, warning sound off)	a.) Door opened b.) Door switch reacts at closed door	a.) Close the door b.) Check the door switch and control disc
Ventilation in operation, heating connected, (no heating up)	a.) Error message at the temperature controller b.) Rated value on the temperature controller is lower than real value	a.) See operating instructions of the controller b.) Check the rated value on the controller
Ventilation in operation, heating disconnected, error message of the Temperature and warning sound is on	a) Sensor breakage of the temperature sensor (Pt100) of the temperature limit cut-out (TLC) b.) * TLC has disconnected c.) * Safety temperature limiter (STL) has disconnected	a.) Check the temperature sensor b.) ** Check the setting; press the reset keys on TLC and on the switchboard c.) ** Press the reset key on STL

Error diagnosis

6.2 Operating failures

FAILURE	CAUSE	REMEDY
Error message at the controller	See operating instructions of the controller	See operating instructions of the controller
Error message of the circulating air and warning sound is on	a.) * Flow switch "Circulating air" doesn't react b.) Motor protection switch has triggered	a.) * Check the flow switch, measuring hoses and measuring set and inside of the working space (loading, cleanness) b.) Press on-key; check motor protection switch
Error message of the exhaust air and warning sound is on	a.) * Flow switch "Exhaust air" doesn't react b.) Motor protection switch has triggered	a.) * Check the flow switch, measuring hoses and measuring set and the supply and exhaust air lines b.) Press on-key; check motor protection switch
Heating disconnected, error message of the Temperature and warning sound is on	a) Sensor breakage of the temperature sensor (Pt100) of the temperature limit cut-out (TLC) b.) * TLC has disconnected c.) * Safety temperature limiter (STL) has disconnected	a.) Check the temperature sensor b.) ** Check the setting; press the reset keys on TLC and on the switchboard c.) ** Press the reset key on STL

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Auftretende Störungen sind unverzüglich durch autorisiertes Fachpersonal zu beheben!

Störungen werden durch rote Leuchtmelder angezeigt.

Störmeldungen werden mit einer Blitzlampe (rot) "Sammelstörung" ^{1.)} angezeigt.



Werden die Betriebszustände nicht mit weißem bzw. Störungszustände nicht mit rotem Leuchtmelder angezeigt, zusätzlich Glimmlampe überprüfen.

Mit dem Aufleuchten eines Leuchtmelders "Störung" ertönt ein Signal.
Tür Öffnen. - Signal verstummt.



Hinweise:

Bei einem Neustart (Hauptschalter ein) kann die Heizung erst nach einer Sicherheits-spülzeit (5facher Luftwechsel des gesamten Dampftraumes durch den Mindest-Abluftvo-lumenstrom) bei geschlossener Gerätetür eingeschaltet werden.

Nach dem Beheben einer Störung muss zum Quittieren der Störung der Drucktaster "Reset" betätigt werden.

- Störung quittiert, roter Leuchtmelder der Störung erlischt.
- Spülzeit läuft ab.

Nach erfolgter Spülzeit: → *please see section "2.4 Technical data" (page 13)*

- Freigabe zum Heizbetrieb.
- Leuchtmelder "Heizung aus" erlischt.



* Sicherheitstechnisches Bauteil, bei bleibender Störung Rücksprache mit einer Vötsch-Servicestelle.

** Rückstellung erst, nachdem Gerät um ca. 50 °C abgekühlt ist.

^{1.)} *additional equipment*

Error diagnosis

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7 MAINTENANCE



The safety and serviceability of the equipment is only guaranteed if the necessary checks and repair works are carried out either by expert skilled personnel or by our service people.

We recommend to sign a service and maintenance contract with our service department.

The maintenance and cleaning work may be done by an expert user.



Expert is a person who by his technical education and experience has sufficient knowledge in the section of the heating and drying cabinet and is familiar with the corresponding workers' protective regulations and the regulations and standards.



Switch the main switch off before you start with the maintenance and repair work and secure it against reconnection.

Please indicate the data of the nameplate if you contact us for questions or spare parts orders!

Service address: → *please see section "10 Documentation" (page 87)*

7.1 Testing and maintenance



The device and its safety appliances have to be tested by an expert regularly and at appropriate intervals, but at least once a year, the temperature limit cut-out even monthly!

We recommend to document the tests proof in a test book or in an EDP documentation. The test may be shown by a badge.



7.1.1 Test the flow switches Circulating air and Exhaust air

The tests of the flow switches are to be carried out only by qualified persons.

- Test the measuring hoses and measuring sets for circulating air and exhaust air for free passage and clean them if there is condensate in them.
- Test the function of the flow switches for circulating air and exhaust air individually.
- Pull off every single measuring hose of the flow switches when the unit is switched on and check the error message (circulating air-/exhaust air error).

If the function of the flow switches is OK the optical and acoustic error indication has to react and the heating has to switch off if it was connected before.

- Reconnect the measuring hoses correctly.
- Press the push button "Reset" on the switch box.
- Scavenging time passes.

Replace damaged measuring hoses and measuring sets for circulating air and exhaust air or damaged flow switches.



7.1.2 Test the minimum extracted-air flow rate

The test of the minimum extracted-air flow rate is to be carried out only by qualified persons.

- Attach a pipe (length about 1 m) to the exhaust air collar of the unit (stabilisation stretch).

At units with a fixed piping installation a measuring hole (diam. = 40 mm) has to be installed at a suitable place on the exhaust air line (on a straight pipe segment about 1 m behind the exhaust air collar).

→ *please observe section "4.4.2 Exhaust air systems" (page 36)*

- Measure the minimum extracted-air flow rate of the cold dryer with the exhaust air fan running (100% Exhaust air).



The minimum extracted-air flow rate may be adjusted at the mechanical damper flap.

Minimum extracted-air flow rate:

→ *please observe section "2.4 Technical data" (page 13)*



If the minimum extracted-air flow rate cannot be adjusted.

Please contact a Vötsch Service point (see annex).



7.1.3 Test the safety temperature limiter (STL)

Test the function of the STL at appropriate intervals:

Raise the rated value limitation of the temperature controller by about. 50 °C.

(see Operating instructions of the temperature controller manufacturer)

Place a suitable temperature sensor in the middle of the working room and connect it to a temperature measuring instrument or to a recorder.

Set the rated value of the temperature of the temperature controller to max. and heat the dryer up to above of the rated temperature while watching it.

The STL has to switch off at about 30 °C above rated temperature in the middle of the working room

- Red pilot lamp "Error heating" is shining.

Set the rated value limitation of the temperature controller to the original value (rated temperature).

Reset the STL only when the dryer has cooled down by about 50 °C.

- **Press the push button** under the screw cap of the STL (at an ambient temperature of at least 20 °C) **firmly with the aid of an appropriate tool.**
 - Red pilot lamp "Error heating" goes out.



Danger:

On units where coating residues have accumulated (dust, condensate, etc.) a special caution is necessary since vapours steam/smoke could be generated when overheating the dryer.

A fire hazard cannot be excluded.



7.1.4 Test the temperature limit cut-out (TLC)

Test the serviceability at least once per month by instructed skilled personnel.

- **Set the TLC to a temperature lower** than the current temperature.
 - the heating is switched off by the TLC,
 - Pilot lamp "Error temperature" is shining and the acoustic alarm is on.
- **Set the TLC again to a temperature higher** than operating temperature.
- **Press the push button "P"** for resetting the error message.
- **Press the push button "Reset"** on the switch box.
 - Scavenging time passes.

Faulty temperature limit cut-out have to be replaced.



7.1.5 Connections of the heating

- Check the terminals of the heating behind the cover at the left side of the exterior housing for correct condition and fixed screws.
- Measure the power consumption with a tong amperemeter.
rated current: → *please see section "2.4 Technical data" (page 13)*
(only by skilled electrician)

7.1.6 Door seal

- Check the silicone / continuous strand seals for damages and contact pressure.
- Treat the silicone seals with talc.

7.1.7 Closing bars and door hinges

- check for wear.

7.1.8 Working space and exhaust air lines

- remove residuals (condensate).

7.1.9 Exhaust air fan

- remove residuals (condensate).
- do not remove or slide the balancing clamps at the impeller.

7.1.10 Moving parts like telescopic rails ^{1.)}

- remove residuals.
- lubricate with BEL-RAY 1030 Grease Hellube 148.
(Deutsche TOTAL GmbH, Kirchfeldstr. 61, 40217 Düsseldorf)

7.1.11 Filter cooling of the switch box

- Beat out, vacuum, or blow out with compressed air.
- Rinse with water of max. 40 °C.
- Use only washing powder for delicate fabrics which are usual in the trade.
- Replace the filter mat if there are fatty dusts.
- Do not wring it out and avoid a hard water jet.
- Pay attention to a correct inserting of the filter mat.

^{1.)} *additional equipment*

7.2 Repair



After the repair of electrical components a safety test has to be carried out.



The following has to be verified at this:

- Visual check of the workmanlike execution.
- Insulation resistance > 1 MOhm
- Protective conductor resistance < 0,1 Ohm
- Equivalent leakage current ≤ 15 mA



7.2.1 Flow switches and measuring equipment

Replace damaged flow switches, measuring hoses, and measuring sets for circulating air and exhaust air.

Set the flow switch circulating air:

- Take over the set value of the previous flow switch circulating air.
- Increase the set value of the flow switch (about 0,5 mbar), until a switch-off occurs (Error circulating air).
- Decrease the value at the flow switch again by 0,5 mbar after the switch-off.

Set the flow switch exhaust air:

- Set the smallest value at the flow switch exhaust air.
- Measure the minimum extracted-air flow rate and set it if necessary,
(→ please see section "7.1.2 Test the minimum extracted-air flow rate" (page 74)
- Heat the dryer up to rated temperature while the exhaust air fan is running.
- Increase the value at the flow switch exhaust air, until a switch-off occurs (Error exhaust air).
- Decrease the value at the flow switch again by 0,1 mbar after the switch-off.



The correct function of the flow switches circulating air and exhaust air has to be tested after replacing them,

→ please see section "7.1.1 Test the flow switches Circulating air and Exhaust air" (page 73)



7.2.2 Temperature limit cut-out (TLC)

Replace the damaged temperature limit cut-out .



Setting of the switch-off temperature:

- take over the disconnecting temperature of the previous temperature limit cut-out .
Disconnecting temperature:
→ *please observe section "2.4 Technical data" (page 13)*



7.2.3 Door seal and contact pressure of the door

Replace the damaged door seal:

Silicone-door seal

- Loosen only slightly the screws of the interior sheet of the door to change the silicone-door seal, remove the defect door seal and install the new seal in the same way.
- Fasten the screws of the interior sheet of the door again.

Continuous strand door seal ^{1.)}

- Loosen only slightly the screws of the pressing angles at the side of the continuous strand door seal, remove the defect door seal from the groove and install the new seal in the same way.
- Press the pressing angles against the new continuous strand door seal and fasten the screws again.

Set the contact pressure of the door seal:

- Loosen only slightly the screws of the bushing at the pivot point of the door, align the door in the elongated hole of the bushing and fasten the screws again.
- The contact pressure at the lock side is given by a correct condition of the door lock.



7.2.4 Door lock and closing bars

Change a defect door lock:

- Loosen the locking screw of the door lock at the interior side of the door.
- Dismantle the door lock.
- Change the defect parts.
- The assembly is done in reverse order.

^{1.)} *additional equipment*



7.2.5 Exhaust air fan

Replace defective, running out of true or damaged fans.

Mounting of the exhaust air fan:

→ *please observe section "4.3.1 Mounting of the exhaust air fan" (page 34)*



The repair of fans should be done exclusively by the manufacturer to guarantee a workmanlike and proper repair and tested balance.



7.2.6 Disassembly of the heating

- Unscrew the cover sheet at the left side of the unit wall;
- Disconnect and mark the heating contacts;
- Loosen the fastening screws at the lower sheet metal shell of the air guide;
- Remove the sheet metal shell of the air guide;
- Loosen the screws of the offset floor panel;
- Pull the offset floor panel out to the front;
- Loosen the fastening screws of the heating;
- Remove the heating to the inside.

The assembly is done in reverse order.

7.2.7 Disassembly of the circulating air impeller with motor

- Loosen the fastening screws at the lower sheet metal shell of the air guide;
- Remove the sheet metal shell of the air guide;
- Loosen the screws of the offset floor panel;
- Pull the offset floor panel out to the front;
- Loosen the connecting screw of the impeller at the motor shaft;
- Loosen the impeller from the motor shaft with a tool;
- The impeller stays still loose on the motor shaft;
- Tilt the unit;
- Disconnect and mark the motor contacts;
- Loosen the fastening screws of the motor;
- Take the motor out and remove the loosened impeller from the motor shaft.

The assembly is done in reverse order.



When disassembling the heating and the fans or replacing the door seal special attention has to be paid to the hazard of injuries by contusion or cutting.

Recommendation:

Use suitable protection equipment.

For further repairs:

Contact a service point of Vötsch (see appendix).



Notice:

When disposing of a dryer the door has to be removed for safety reasons, to avoid the danger of locking up oneself or somebody. → *please observe section "4.7 Disposal" (page 43)*

**7.2.8 Filter ^{1.)}**

The soiling of the filters depends very much on the conditions at the erection place of the unit. The time intervals for the necessary replacement are determined by the respective operating conditions.

The filter has to be changed when the differential pressure is the double of that at the beginning.

Fresh air filter:

Fresh air filter class F 5 according to EN 779

Disassembly of the filter mat

- Loosen the clamping screws of the exterior lattice;
- Remove the exterior lattice;
- Remove the polluted filter mat;
- The inserting of the new filter mat is done in reverse order.
- Push the mat under the border of the bottom and the top side.

^{1.)} *additional equipment*

7.3 Cleaning



Before cleaning the unit switch off the main switch and lock it against re-connection.

Clean the working space and -equipment, the exhaust air lines and circulating air-exhaust air measuring sets.

Clean the filter of the switchbox cooling regularly to guarantee an overpressure in the switchbox.

This prevents the penetration of dust.

If equipped with a filter for fresh / circulating air.^{1.)}
→ *please observe section "7.2.8 Filter ^{1.)}" (page 80)*

Remove thoroughly coating residues.

The time intervals for the necessary cleaning depend on the operating conditions.

Cleaning only when the unit is cold.



Use only usual in the trade household detergents.

Take care of a sufficient venting during the cleaning.



Do not use combustible, toxic or acidiferous detergents.

Set the dryer in operation only after a sufficient venting.



Recommendation:

Use suitable protection equipment.

^{1.)} *additional equipment*

Maintenance

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
















8 CONNECTION DIAGRAM

8.1 Spare parts list of the switch box

- in the connection diagram appendix

Connection diagram

8.2 Graphic Symbols

	Net		Clock
	Ready		Illumination
	Start		Lamp test
	Stop		Observe accompanying documents
	Automatic operation		Heating
	End of program		Heating off
	Start of program		Air
	Limitation of maximum value of temperature		Circulating air
	Failure		Exhaust air
	Reset		Exhaust air off
	Acoustic signal		
	Acoustic signal off		
	Ventilator		
	Butterfly damper		
	Recorder		

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9 SPARE PARTS LIST

For 400 V, 3~	60/60
Heater (2.0 kW, 230 V) (E3)	63 621 040
Heater (free of silicone) ^{1.)}	on demand
Motor circulating air fan 16 m³/min (M1)	63 510 074
Motor circulating air fan 33 m³/min (M1)	60 886 079
Impeller	50 021 560
Impeller (stainless steel) ^{1.)}	50 022 026
Exhaust air fan (M2)	50 021 081
* Door seal silicone (3.4 m)	50 021 164
* Door seal glass fibre (3.4 m) ^{1.)}	50 017 177
* Bearing bushing (brass)	52 250 225
* Door locking complete (without closing bar)	52 040 121
Door switch (S1)	50 023 160
Horizontal air guiding ^{1.)} conversion kit	52 250 171

^{1.)} additional equipment

* wearing part for 2-year service

Subject to changes

Spare parts list

	60/60
* Filter mat (fresh air filter class F 5) ^{1.)}	53 985 294
* Filter cartridge (fresh air filter class H 13) ^{1.)}	50 014 783
Support bracket, shape U 1 piece (stainless steel) ^{1.)}	52 250 210
Wire-mesh shelf (chromium plated) ^{1.)}	52 310 050
Wire-mesh shelf (stainless steel) ^{1.)}	52 310 051
Grating (hot-dip galvanised) ^{1.)}	52 310 053
Grating (stainless steel) ^{1.)}	52 310 054
Loading tray 1/1 size (aluminium coated steel sheet) ^{2.)}	52 310 055
Loading tray 1/2 size (aluminium coated steel sheet) ^{2.)}	52 310 057
Loading tray 1/1 size (stainless steel) ^{2.)}	52 310 056
Loading tray 1/1 size (stainless steel) ^{2.)}	52 310 058
Flow switch circulating air (F1)	50 021 476
Flow switch exhaust air (F2)	50 021 477
Measuring set circulating air	53 310 213
Measuring set exhaust air	50 021 190
Hose for measuring equipment (6 m)	53 667 303
Hose clamps for measuring equipment	53 659 003
Hose clamps for flow indicator	53 659 006
Pt 100 (B1, B2 ^{1.)} , B11 ^{1.)})	63 832 142
Flexible thermoelement (B11 ... B16) ^{1.)}	50 018 094
Safety-Temperature Limiter 300 °C (STL)	50 021 217
Flash light orange (H82) ^{1.)}	50 023 339
Flash light red (H8) ^{1.)}	50 023 338
Roll sheet paper for "Logoline 500d" ^{1.)}	on demand
Folded sheet paper for "Logoline 500d" ^{1.)}	on demand

^{1.)} additional equipment

* wearing part for 2-year service

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10 DOCUMENTATION

Temperature controller dTRON 04.1	Jumo
Temperature controller Dicon 1001 ^{1.)}	Jumo
Temperature controller 2404 CC ... CM ^{1.)}	Eurotherm
Recorder ^{1.)}	Jumo
Certificate of Conformity / Manufacturer's Declaration CE	Vötsch
Service points	Vötsch

^{1.)} *additional equipment*

Manufacturer's address

Vötsch Industrietechnik GmbH
Umweltsimulation - Wärmetechnik
D-35447 Reiskirchen - Lindenstruth
Greizer Str. 41 - 49
Telephone (06408) 84 - 73
Telefax (06408) 84 - 8747
Internet <http://www.v-it.com>
email: info-wt@v-it.com

Service address / Hotline Wärmetechnik

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Telefax (06408) 84 - 8718
email: service@v-it.com



Please indicate the data on the nameplate for checkback and spare part orders!



The information and statements of the German Operating Instructions are binding upon translations in other languages!

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